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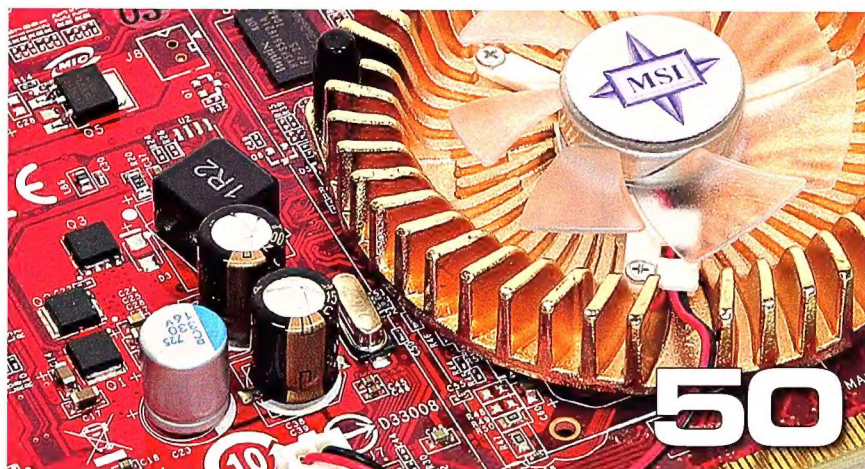
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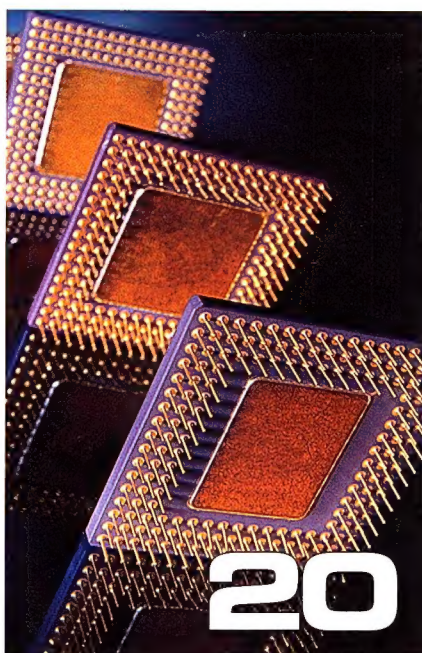
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Force fool

Back when 'home' was a cubicle on the 2nd floor of my parent's house and my 'ride' was the rusting hulk of a 1979 Gemini less roadworthy than an Acme-branded rocket flung from a giant novelty slingshot, money was a precious commodity. Technically it still is, but these days it's a bit easier to throw away a dollar on a packet of gum instead of say, sticking a chewed piece in the fridge to extend its masticatability. During these trying times, keeping my PC performing at a reasonable speed was quite a challenge.

Although all my upgrades have been memorable in their own right, there is one I will never forget – and that was the replacement of my GeForce2 MX with a GeForce4 MX.

To say that I was swindled would be an understatement. Yet, it wasn't the remote and tiny PC shop that robbed me of my money. No... it was NVIDIA.

You see, the GeForce2 series, regardless of whether you bought the high-end GTS or the low-end MX, came packed with the same features. The only difference was the performance. Fine by me – as long as my MX could theoretically run the same games as the GTS, I'd make do.

The GeForce4 MX however had nothing on its beefier GeForce4 Ti siblings. Despite being of the same line, the MX did not have the ability to process pixel shaders. I would miss out on the gorgeous waters of Morrowind and, as time progressed, the gorgeous waters of countless other games.



I was devastated, but put it down to poor research; a hard-learned lesson.

Years later and with wisdom on my side, it was really a blessing. There's no way my MX would've handled the load of pixel shaders in its already crippled state.

Simply put, if you want the best visuals you have to pay for them. If the MX had come with pixel and vertex shader units, I would have been even more disappointed when I jumped into Morrowind only to be rudely greeted by two frames every second.

Sadly it seems NVIDIA touched minds with my younger self and has since reverted to providing the same feature set across each generation of cards. Oh joy, you may squeal, but consider the consequences.

Perhaps this wasn't so bad for the GeForce 6 and 7 series, which failed to introduce anything particularly groundbreaking, but the 8 series boasts a fundamental change – support for DirectX 10. Until now, only the 8800 GTX and GTS could make this claim.

Now we have the 8500 GT, 8600 GT and 8600 GTS, NVIDIA's supposed 'boon' to the mid-range. And they all support DirectX 10. But do you honestly think they're going to handle something like Crysis?

The answer to this question is 'No'. A huge stinking 'No'. Check out our DX 9 benchmarks and watch these three cards fall short of even 30fps on previous-gen games. Accurate as it may be to advertise them with DX 10 support it is legerdemain of the highest order.

Be warned – if you decide to cheap out on the road to next-gen, expect the worst.

Logan Booker
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To see the latest Atomic competitions, visit www.atomicmpc.com.au/competitions. The closing date for entries is 13 June 2007. Winners will be announced in Atomic 79.

Atomic 75 winners: 10x UFO: Afterlight prize packs. S. Elliott, Ilkley QLD; K. Kelling, Nerang QLD; E. Davey, Bell Park VIC; A. Tse, Randwick NSW; N. Clarke, Seaford SA; E. Karpel, Mayfield NSW; W. Berzanskis, Newcomb VIC; R. Yap, Point Clare NSW; E. Malinowska, Thomastown VIC; N. Hunt, Kelso NSW. 5x Ergo Proxy V1. T. Daley, St Albans Park VIC; I. Pratt, Kambah ACT; D. Benson, Inala QLD; T. Ginsberg, Glen Eden NZ; K. Auer, Cranbourne VIC.

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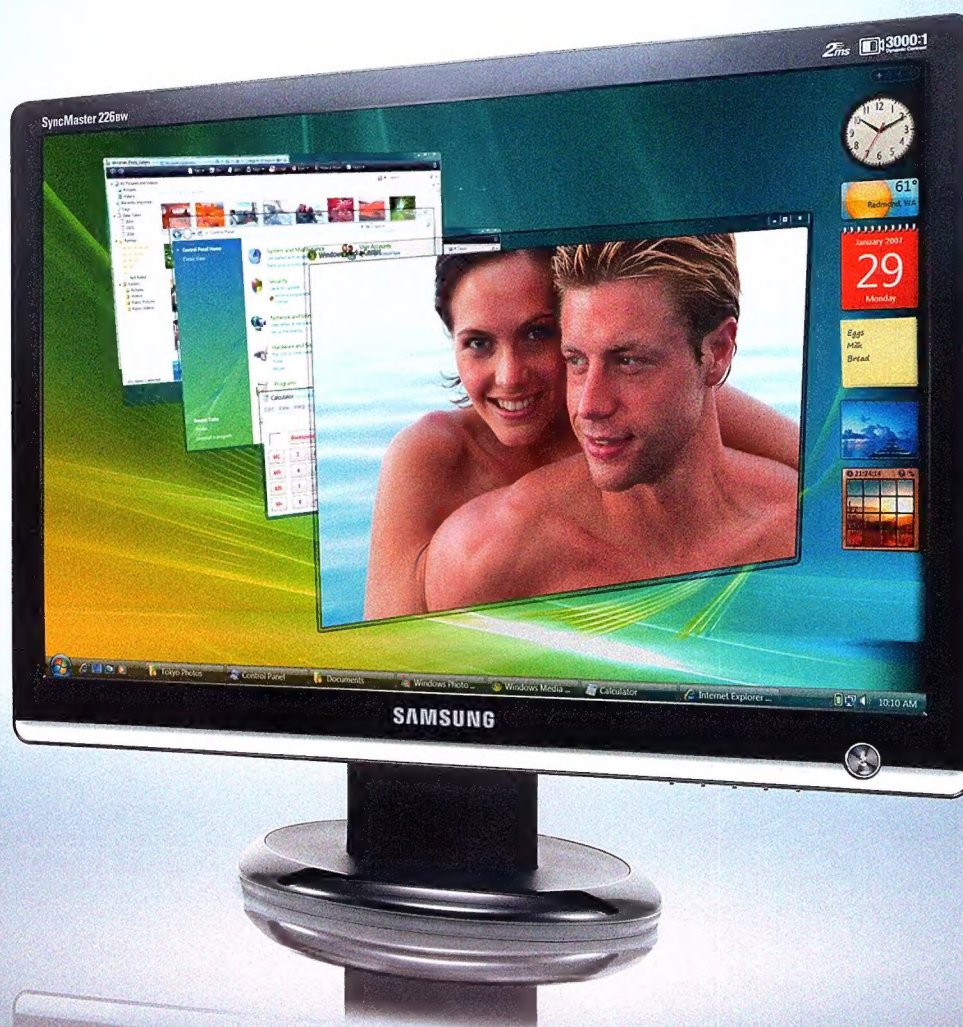
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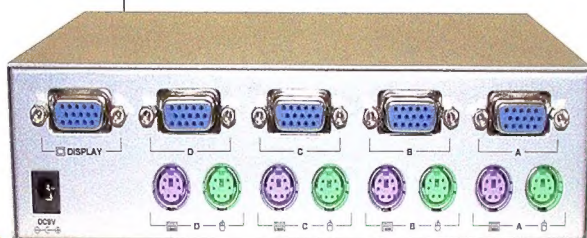
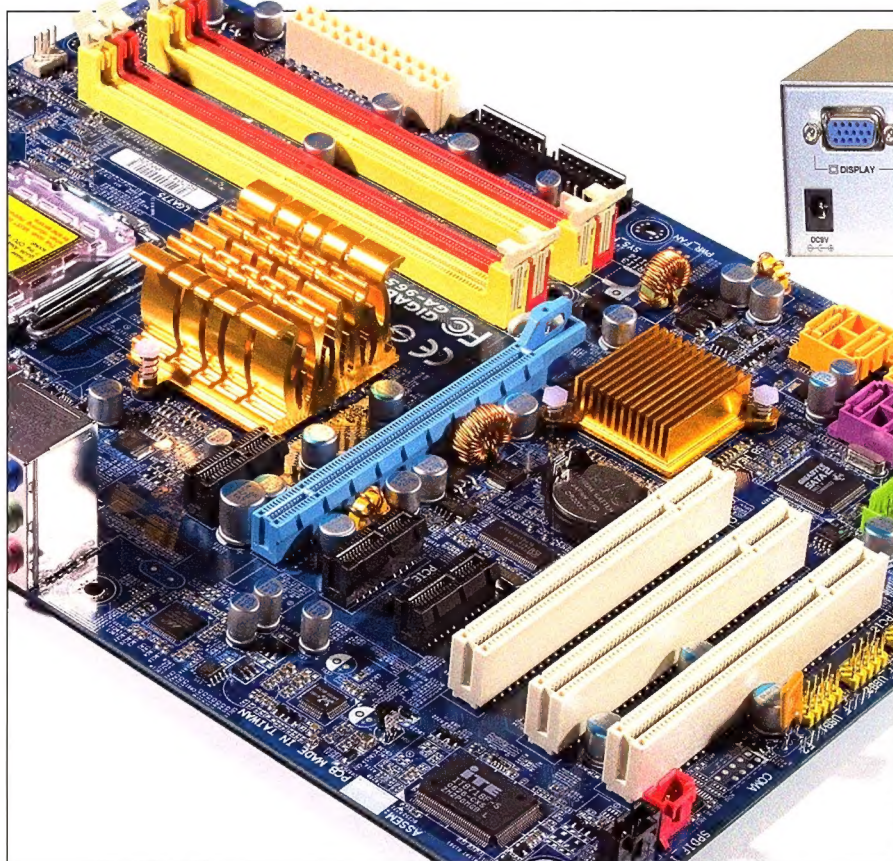
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PS2 is dead. Long live PS2!

they still want these features on the board. Considering our mixed experiences with using USB keyboards in the BIOS, we recommend they keep the PS2 ports for a bit longer. Other rumours include a 10Gb/s Ethernet controller. AMD on the other hand has the RD790 chipset, which features PCI-E 2.0, HyperTransport 3.0 and should be paired with the SB700 southbridge. RX790, RS790 and RS740 are less exciting, with the RX790 being based on the RD570 chipset, the RS790 the same except with a DX 10 integrated GPU, and the RS740 the same with a DX 9 integrated GPU. Rumour has it the RD790 supports Ethernet teaming like NVIDIA's 680i.

SATA should also get a nice little upgrade to 6Gb/s, as well as the capability to hook multiple devices into the one port – supposedly ICH9 has this technology, but until we see the whitepapers we won't know for sure when this will turn up, or even be used on the desktop.

On the NVIDIA side MCP72 will soon be a reality for AMD, supporting HyperTransport 3 and PCI-E 2.0 on Socket AM2+. This will be a single chipset rather than the split model seen in the nForce 4, 5 and 6 series boards, leading us to wonder how SLI support will be handled. An MCP78 should follow with integrated DX 10 GeForce 8-based graphics.

It's nice to know things are always evolving, but for now we'd say Intel is well and truly on top.

Motherboard madness

Craig Simms is bored of boards.

There are changes afoot in the motherboard world, due mainly to DDR3. Intel plans to replace its current chipset line-up with what it calls 'Bearlake'. There will initially be four variants – P35 (the P965 replacement), which supports DDR2/3, 1333MHz FSB and features the ICH9 southbridge; G35, which is the same as P35, but with an integrated DX 9 GPU; and X38 (the 975X replacement), which will be for the enthusiast market and features all the P35 does plus PCI

Express 2.0 (5GHz clock compared to PCI-E's 2.5GHz) and dual PCI-E x16 slots. This will also come with an integrated graphics alternative, although in this case featuring support for DX 10 and HDCP.

The ICH9 southbridge also supposedly does away with more legacy gear – PS2 keyboards and mice are no longer supported, and LPT ports have been dropped as well, requiring partners to include a separate controller if

SHORT CIRCUITS

Marvell, Nokia and VirtualLogix have joined the Linux Foundation – this should ensure better driver and software support for the open source OS.

AMD has more than halved the price of the Athlon 64 X2 6000+ since we reviewed it. It now represents excellent value indeed. Other chips below this have also reduced considerably in cost. Meanwhile Intel continues to tighten the screws, releasing the extremely potent quad-core QX6800 at 2.93GHz.

The Xbox 360 has hit another update, with Windows Live Messenger being integrated and a bizarre QWERTY keyboard/joystick controller thing to be released in the winter.

The update also allows people to fast forward, pause or rewind a video while it's being downloaded.

You can now also set the 360 to turn off when downloads are complete, and it supports H.264 and MPEG-4. Looks like Microsoft is taking on the PS3 quite well.

Rumour has it the HDMI version of the R600 (now X2900) will have a Realtek sound chip on-board, so HDMI can live up to its full spec. The reason why it will be included is



Die, die, die DRM

Apple takes two steps forward, one step back, writes Craig Simms.

EMI has started offering DRM-free MP3s for sale on band's websites, with such groups as 'The Good, the Bad and The Queen' offering 320Kb/s quality files.

Things aren't so rosy on the Apple front. By virtue of EMI's partnering with it, the DRM-free tracks are now offered through iTunes, however at a reduced bitrate – 256Kb/s – and still sold in Apple's annoying AAC format, essentially still locking users to the iPod unless they convert the files first on their PCs.

The original 128Kb/s DRM-infected files are still available for the same old price. We'd love to tell you the Australian price of the DRM-free tracks, but they won't be released until May. For America, it's US\$0.30 more per track, while albums stay the same price. Apparently you can also 'upgrade' tracks for the price difference.

Even Microsoft has stated it will be following suit (in a completely unrelated, separatist, was-its-own-idea way of course). All in all it's a good thing. We figure it'll only take another five years before everyone catches up to the perfect model – allofmp3.com – which by then may be destroyed by legal proceedings.



PhysX's killer app?

AGEIA ancient, forgotten... except by Craig Simms.

It looks like Cell Factor – the game that was meant to catapult AGEIA's PhysX to popularity – is not in fact dead, and will be released as Cell Factor: Revolution. The kicker is it will be completely free – no doubt as a result of AGEIA throwing a fair amount of cash around.

It'll be available for download from May 8, although only two multiplayer levels will be playable for non-PhysX card owners. From what we can see real-time fluid and cloth simulations are still a bit beyond the CPU, even if AGEIA's fluid looks like it was belched from the belly of a Scotsman who's



drunk nothing but tar for the last seven years.

AGEIA has announced that it'll be updating its cards as well, moving from a 130nm to an 80nm process and offering a PCI-E x1 solution –

although the latter will only be seen OEM, retail will be stuck with PCI. Then there's Unreal Tournament 3 coming soon, which will have PhysX specific levels – and we'd argue is AGEIA's biggest hope to launch its technology.

Given that Crysis runs its physics on CPU just fine, we wonder if AGEIA's second coming will grab any market share at all.

The problem? No one cares.

apparently to make sure an unencrypted audio stream can't be used, with both video and audio being subjected to HDCP and making it Vista logo-compliant. Can someone tell the entertainment companies that even the record labels are beating them to disabling the DRM crap?

The Internet Corporation for Assigned Names and Numbers (ICANN), essentially the closest thing we have to an Internet governing body, is looking for a way out of the US due to the Bush Administration's

attempts to tighten America's grip on Net control. The idea of moving it to Switzerland and making it an international company was floated last year, although this news is only just now coming to light. Running as an international company would make it immune to lawsuits and various US taxes.

Sony has killed the 20GB edition of the PlayStation 3 in the US, following its non-release in Australia. No doubt it will follow up with the axing of the Emotion Engine. It's all about choice and flexibility, right?

FUTUREPROOF

Gazing into the crystal ball of tech

Intel on Intel

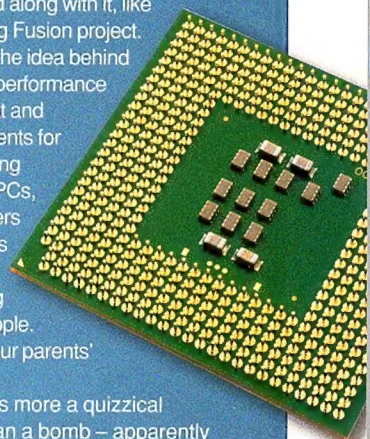
The Nehalem processor of the famed '10.2GHz by 2005' claim is emerging, albeit in a slightly more humble form.

The real Nehalem is a 45nm part, successor to Penryn and is set to take us to eight cores and beyond. It also gives Intel the capacity to customise cores to specific feature sets to suit certain industries.

There are two big bombs coming along with Nehalem – and both of them following AMD's lead. The first is that the memory controller will be moved on-die, as was done with the Athlon 64 years ago. The second is a GPU will be integrated along with it, like AMD's upcoming Fusion project. As with Fusion, the idea behind integration isn't performance

– it's to lower heat and power requirements for specific computing like laptops, HTPCs, rackmount servers and low-end PCs that have no business playing games (read: Apple. Okay, maybe your parents' machine too).

A third entry is more a quizzical rubber bullet than a bomb – apparently HyperThreading will be back in a different form for Nehalem. An eight core CPU being able to load 16 threads? We hope it will be implemented more successfully than its forbearer.



POST OF THE MONTH

One awesome quality of the Atomic forums is the massive amount of knowledge that can be found in its depths. If you're brave enough to explore them, you will surely find greatness. POTM rewards the greatest of the greatest.

In the words of Nick Frost, it's all about the three 'S's: Security, security, security. Atomic forum goer Kristijan seems to know everything there is to know about the magical S-word, going by his excellent post on tightening wireless networks for BSD-flavoured operating systems:

POTM:

How-To: Adding extra security to wireless networks with AuthPF

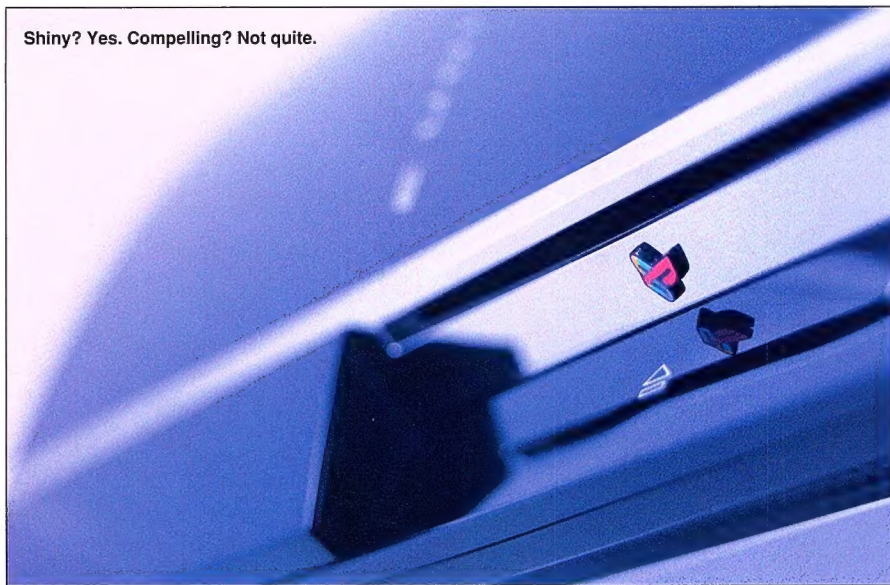
www.atomicmpc.com.au/forums.asp?s=2&c=22&t=388

A most excellent post! Kristijan, keep an eye out in the mail, a fantastic Logitech mouse is on its way to you!

Every Post of the Month wins a fabulous Logitech mouse from the brilliant people from Logitech... Huzzah!!!!



Shiny? Yes. Compelling? Not quite.



PS3: behind the launch

Was the PS3's lacklustre midnight launch indicative of its overall sales? David Kidd finds out.

When the PlayStation 3 had its midnight launch on 23 March, it didn't live up to the rabid fan fest of the US and UK. That's a nice way of saying the launch was reported as lame by the few who turned up. You could have taken this two ways: Either the PS3 was destined to flop massively, or midnight launches just aren't our thing. According to Sony, it would appear to be latter. The company line, as reported on the *SMH* blog Screen Play,

was that 20,000 units were sold in its first three days on shelves, generating \$25 million in sales.

Now, it's not that we don't trust Sony, but being the professionals we are, we went straight to the source of the figures to find out exactly how well Sony's behemoth console went in Australia.

According to Daniel Morse, game analyst at GfK, the console generated \$33 million in revenue in its first ten days on sale, which is a landmark figure in Australian console sales.

'Our data revealed that in a matter of just ten days the PlayStation 3 created a spike in retail spending not previously witnessed at the launch of any other console in Australia,' said Morse.

Astute observers will note that this figure doesn't particular tell us much – the most expensive mainstream console ever released is likely to, you know, pull in more money. According to Morse, the PS3 sold 27,083 units in the first ten days, compared to the 11-day figures of 36,627 for the Xbox 360 and 41,369 for the Wii.

According to Sony spokesperson Adrian Christie, the comparatively low unit sales on the PS3 come down to the PS3's substantially higher price. However, this high price has pitched the PS3 at a different market than the Xbox 360 and Wii.

'We're all tempted to compare like for like, but they're not like for like... we're reaching a different consumer,' said Christie.

Morse, however, believes there's another factor at play here that's limiting sales: Games.

'One of the other factors was the launch line up of games, although they were good in their own right, the launch lacked the so-called "killer app". Remember the Wii launched with *Zelda* and [Xbox] 360 launched with *Elder Scrolls 4*,' said Morse.

The most controversial design decision in the PAL version of the PS3 was the omission of the Emotion Engine/Graphics Synthesizer combo chip. The EE/GS provides backward compatibility with PS and PS2 games; without it, the Australian version relies on hit-and-miss software emulation.

Despite it supporting less than 10 percent of the entire back catalogue, Christie doesn't believe it's affected sales.

'I think some people were initially disappointed, because it was something they had expected,' said Christie. He believes however that people are more focused on the future. 'People are less inclined to go backwards... the [ability to play older games] was a "nice-to-have",' he added.

“Either the PS3 was destined to flop, or midnight launches just aren't our thing.”

SHORT CIRCUITS

The French seem to think Peter Molyneux is worthy of knighthood, bestowing him the Chevalier de l'Ordre des Arts et des Lettres, (The Knighthood in the Order of Arts and Letters). Of the title, Molyneux said: '...I see this as a credit for everyone at Lionhead Studios, all our games are a team effort. I am just the figurehead'.

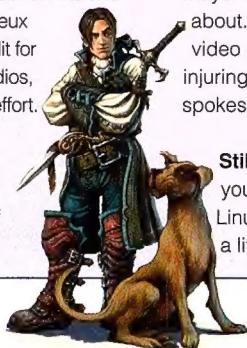
The upcoming GTA IV: Liberty City is already off to a controversial start.

Although Liberty City is a fictional location, it's based on a modern day New York City, consequently giving Mayor Bloomberg something to cry about. 'The mayor does not support any video game where you earn points for injuring or killing police officers,' said a spokesperson for Bloomberg.

Still holding out for the day when you can run Windows games on Linux? Transgaming has taken us a little closer with the release of

Cedega 6.0. The new version supports more games, (like *Battlefield 2142* and *Oblivion*), Shader Model 2.0, and offers performance and UI improvements. Check out the list of supported games at transgaming.org/gamesdb.

We'd eat our own grandmother to get a taste of anything related to *Speedball 2*, and unfortunately for her, it looks we're heading to grandma's for dinner. It's online, it's being developed by the Bitmap Brothers, and it's built for the PC. Quite



Hellgate: Diablo

Who better to clone Diablo than the guys that made it?

In Scanner, *issue 77* (page 10), we sat on a hill and watched the advancing hordes of hack-and-slash RPG-lites. Titan Quest, Silverfall and Sacred were set to unleash



their clickety gameplay on us all, forever silencing any desire we might have that involved thinking in a game. Now, it seems those games were just warming us up.

In the midst of working on that futuristic, gothic, first-person action RPG, Hellgate: London, developer Flagship Studios will somehow find time to release a Diablo-inspired hack-em-up called Mythos. It's not a surprising move, given Flagship Studios is comprised of ex-Blizzard employees, but what is surprising is that it's going to be free, with a full online multiplayer service to boot.

Details are scant, but we do know that it will be continuously updated, with instanced dungeons and three classes - Human, Elf and Gremlin. We're also pretty sure it'll be better than the current state of NCSoft's abysmal Dungeon Runners. Sign up at www.mythos.com.

Beta testers out for blood

Age of Conan draws 100,000 beta sign-ups in one weekend.

Maybe it was that the beta program opened over Easter, or maybe there's just an astonishing amount of Conan fans aching to see a version of Hyboria without Arnie, but one thing we do know is that Age of Conan may be the biggest MMO launch since WoW.

Funcom and Eidos announced that 50,000 users signed up in the first 24 hours, and by the time the Easter break was over, they'd collected 100,000 bloodthirsty testers. But don't think that you'll automatically get an account - the beta test will come in phases, and you need to pass a 'test' to play.

Of course, just because an army of



testers has shown up doesn't mean the game will be a bona fide hit. New research from DFC Intelligence notes that the MMO industry is fickle, where new titles often get a spike of players before dropping back into WoW-land.

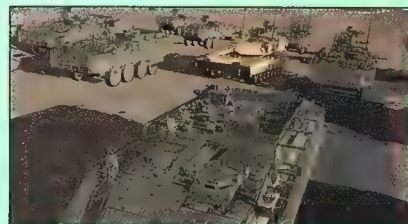
Check out www.ageofconan.com for more info...



why it's PC only and not console is surprising, given that the original only required a joystick and a single button to play.

Telstra's Wi-Fi hotspots around the country (think McDonald's, Starbucks, airports and hotels), will now offer free wireless to Nintendo DS users. If you own a Nintendo DS, boot up a game that supports multiplayer, dive into its config options, select a wireless network from those in range, and start playing. The service is available from over 1000 hotspots.

PIPELINE Hot games to watch out for



Combat Mission: Shock Force

Release date June 2007

Combat Mission was a quietly ambitious game for a bunch of indie developers, with its full 3D engine, attention to detail and a clever turn-based system with 'real-time resolution' movies. Unfortunately the engine just wasn't being updated fast enough, which made CM, a game that was arguably dated when it first came out, in drastic need of facelift.

Now, Battlefront is just about to launch what will likely become its new opus. Combat Mission: Shock Force makes a controversial departure from World War II - it's set in a near-future conflict in the Middle East - featuring modern weapons and an urban setting.

Apparently, Battlefront built CM:SF as a real-time strategy game, but fortunately there's an option for the turn-based/real-time hybrid in the original.

Platform PC

Publisher Battlefront

Web www.battlefront.com



Left 4 Dead

Release date TBA 2007

With the zombie genre taking the place of WW2 games, it looks like Valve wants a slice of the undead action.

Well, that's what it looks like judging by its upcoming survival horror FPS Left 4 Dead.

What's so special about L4D? Firstly, it's developed by Turtle Rock Studios, the folks that have been working on Counter-Strike for the past few years, so it's in fairly safe hands. Plus, its mission structure of 'run, shoot, run, find exit' is classic, tense survival horror action. Finally, it's foremost a co-operative game, requiring teamwork and communication.

L4D will use the Source Engine, and incorporate Turtle Rock's own AI technology. Ironically, it's the AI that Valve is touting as a revolutionary feature, but how much intelligence does a shambling, brain-dead zombie need?

Platform PC

Publisher Valve

Web www.l4d.com



Tony Zurovec

Alexander Gambotto-Burke caught up with the co-creator of *Crusader: No Remorse and No Regret*, and chatted to him about things both old and new in gaming.

atomic Where did the idea for the *Crusader* games originate?

Tony Zurovec: *Crusader* was inspired by the old *Castle Wolfenstein* game on the Apple II. I really liked the fundamental idea of traversing through various rooms, battling enemies that had to see you before they would attack, picking up different items, and even being able to use an enemy uniform so that you could sneak rather than fight your way through some areas. *Wolfenstein* was an elegant idea and I knew that modern technology would allow me to greatly expand on the basic concept.

atomic Why do you think the *Ultima VIII* engine was criticised for its use in an *Ultima* game, but lauded in *Crusader*?

Tony Zurovec: It was never a secret that *Ultima VIII* was going to upset traditional *Ultima* players. That very subject was discussed on several occasions. The problem was that despite each successive *Ultima* costing roughly twice what its predecessor did, sales growth had hit a wall. Garriott, the producer, McShaffry, the director, and the designers gambled that they could grow the potential audience if they took *Ultima* in a significantly different direction, but they never seemed to know exactly what that other direction would be. A lot of development effort was directed away from what players had

traditionally liked about *Ultimas* and towards a seemingly random variety of things that would theoretically appeal to some unknown, far larger audience. My frustration with the direction of that game – well known during its development – was one of the factors that led me to start developing the first *Crusader* in 1994.

atomic Do you think *Crusader* paved the way for the action RPG boom that started in the mid-nineties?

Tony Zurovec: I think that *Crusader* had a definite impact. At the time it came out *Doom*



▲ *Crusader* in all its low-resolution glory.

was dominating *Computer Gaming World's* Readers' Choice Charts. *Crusader* knocked it from the top spot and held onto it for almost a year. I think that woke some people up to the fact that there was still plenty of life in third-person action games... if done well, of course.

atomic What do you think the *Crusader* series introduced to gaming?

Tony Zurovec: I think *Crusader* showed action gamers how much more fun it was when they were encouraged to be creative in coming up with solutions to problems. Prior to *Crusader*, it was common practice to introduce an obstacle like a door and to have scripted only a single way of getting past that obstacle – say, a keycard that had to be found and utilised.

atomic Are development teams getting too large? What are the disadvantages of large teams?

Tony Zurovec: I think that on average development teams have been too large for years. You don't get a better game with 100 people than you do with 25. You get a game with more graphics. You get a game with more units. You get a game with larger maps. Do those things make a game better? No – you just get better screenshots. I think that a couple dozen good people are enough, even nowadays, to create a pretty compelling game. When a team starts to grow dramatically beyond that size, I think that you start to dilute the focus on the most important elements of the game. I think that once a team begins to convert from a relatively flat to a significantly more hierarchical organisational structure that what you're losing in terms of innovation and balance starts to increase dramatically.

atomic How did you become involved in the casual game market?

Tony Zurovec: After we sold Digital Anvil to Microsoft in December 2000, I had to decide



what I wanted to do next. I knew that I wanted to retain ownership of the intellectual property that I developed and I liked the idea of complete creative freedom. Creative freedom is a big issue for me because a lot of the game ideas that I'm really excited about doing aren't like anything already in the marketplace and it's therefore often impossible to get a publisher to understand the potential. The downloadable game marketplace was attractive because its lower cost structure would allow me to personally fund whatever games I wanted to produce and I knew that I'd have an effective means of distribution.

atomic Who is your target audience?

Tony Zurovec: I think that this is one of those questions that developers and publishers often ask themselves that may actually do more harm than good. It's certainly good to analyse the game that you're developing and try to understand what will and won't resonate with players and why, so you can refine the formula. The problem is that it's extremely hard to separate the good aspects of a question such as this from the inevitable and far-less-useful follow-up question – how big is that target audience? That single question is probably responsible for more good games not getting made than anything else. The reality is that if you take a good game idea and manage to get the formula right you might sell twenty times as many copies as any game that genre's ever seen. So, for me, the answer to this question is always simple. My target audience is me, and I just try to get the formula right.

atomic Describe the range of the products your company, Superluminal, releases.

Tony Zurovec: Thus far we've really been in more of an experimental mode with online distribution. We've done everything from a pipe game to arcade-action to word games. Part of the reason we did this was because we were curious how different types of games would be received in this marketplace, but there was also a more strategic reason. Each of these smaller titles has helped to finance one or two pieces of an increasingly robust base of technology. When we begin work on the more ambitious games that I'd really like to do, much of the groundwork will have already been laid and we'll be better able to devote our limited resources to the things that really matter.



▲ Ultima had always employed a top-down or subtly isometric perspective. U8 proved quite the departure.

atomic Any upcoming projects you can mention?

Tony Zurovec: We have one more arcade-action title coming out and then we'll start moving in a significantly different direction. I can't go into too much detail at the moment, but suffice it to say that these future titles will be considerably more ambitious. Truth be told, these will be the games about which I'm really passionate.

atomic Do you find working on smaller, more self-contained games makes innovative game design easier or more difficult?

Tony Zurovec: I think that smaller games are a double-edged sword in regards to innovative game design. On the one hand, smaller games lead to a wider variety of ideas being attempted because of the lower financial barrier. On the other hand, smaller games are often constrained in their implementation by those small budgets.

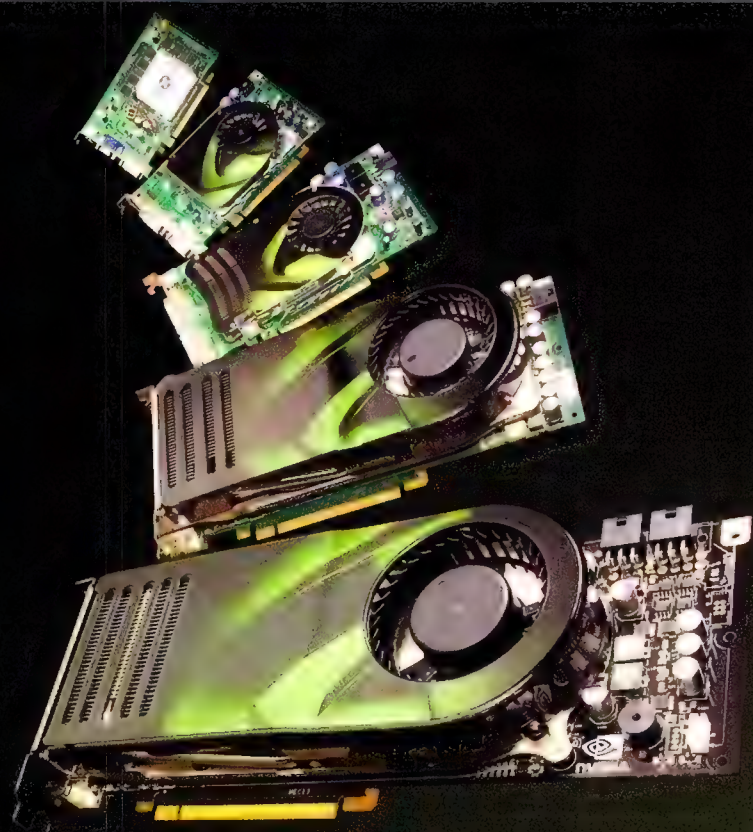
atomic Do you think digital distribution is the future for smaller developers?

Tony Zurovec: Yes, but I also see some storm clouds approaching. Right now there are a few large online game publishers such as Real and Yahoo, but many games are still sold via much smaller publishers and even directly by the games' creators. Breadth of distribution is good for smaller developers. The question is whether or not, as the process of downloading games online becomes more refined, people will begin to gravitate exclusively to those larger sites to find games. If they do, Internet game distribution would begin to resemble the retail model much more so than it does today. 'Online shelf space' would become so valuable that development budgets would skyrocket as features and graphics were added to try and make games stand out so that they could justify at least a shot at one of those coveted spots.

atomic Finally, if it were possible, would you want to do another Crusader game, or take the design principles from Crusader and use them in a new IP?

Tony Zurovec: I'm sure that I will eventually get around to making a game with fairly similar play mechanics. It's just a matter of time.





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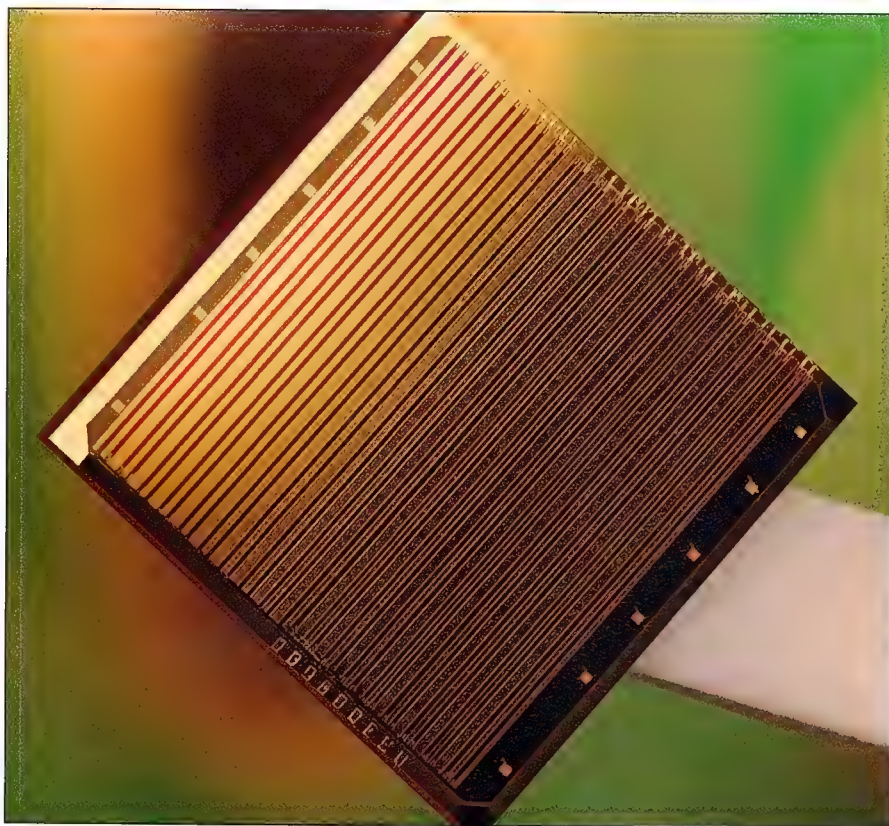


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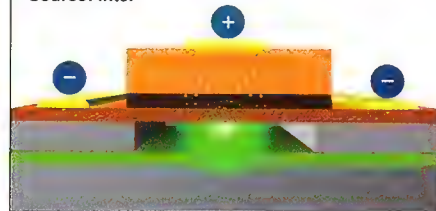
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ATOMICX-RAY

Looking at
tech from
the inside



When current is applied to the indium phosphide, light is generated in the waveguide.
Source: Intel



In silicon photonics, indium phosphide – one of the few materials that emits light when voltage is applied – is bonded directly to the silicon through heating the materials in a plasma and 'gluing' them together. This 'glass glue' as it's called is a tiny 25 atoms thick.

The material and electrodes are bonded to a channel, called a waveguide, in the silicon – when power is applied, light is generated in the waveguide.

Waveguides are literally carved into the silicon and are used to channel, focus or split light. Note that waveguides aren't a 'pit' in the silicon – they are the silicon. To the human eye silicon is opaque, but to laser light in the infrared spectrum silicon is as transparent as glass. Waveguides are literally thin channels of silicon, much like optical fibre, to direct the resultant light from the laser.

But the output of the laser isn't particularly strong, so amplification is needed. In conventional optics, lasers are amplified by introducing a 'pump beam' to the data stream travelling over the glass fibre. Thanks to a process called the 'Raman Effect', as the photons from the pump beam collide with atoms in the carrier material (here, glass fibre) energy is released to photons of longer wavelengths. If the data beam is of the appropriate wavelength, it will pick up these photons and be strengthened over distance.

For traditional optics, this effect occurs over kilometres of fibre. In silicon the effect is pronounced – in fact, it's about 10,000 times stronger. This means that a signal can be amplified over incredibly small distances through a silicon carrier. Which just happens to be exactly what the doctor ordered when building infinitesimally small lasers.

But there's always a challenge. Because the carrier material also intercepts or interferes with photons due to its physical structure, the goal is to have the amplification of a beam to be greater

Silicon photonics

More than just cool-sounding, silicon photonics is the future of computing. Ashton Mills sheds some light on the subject.

Optical communications is nothing new. Much of our communications infrastructure relies on it. Optical fibre is fast, high volume and can handle long distances.

But it's also bulky as all buggery. Not that we need industrial-strength optics when it comes to designing the next-generation of PCs, but one fact remains true: We are pushing the limits of traditional metal conductors, and the high-volume bandwidth the future demands will require processors and pathways between components to handle far greater volumes of data than they do today.

The concept of an optical computer, one whose inner workings are powered by light and not electricity, with data contained in photons and not electrons, is ultimately where we are heading. However, before this can even reach fruition we first need to work out how to use light at the silicon level. Which we'll do – just as soon as the boffins figure out how to make infinitesimally small lasers.

The biggest hurdle to date with sticking optics into integrated circuits has been getting a light source small enough to sit on a silicon substrate. Even the smallest of lasers with current technology would need to be attached and powered externally – but silicon photonics gets around this by embedding the laser directly into the silicon itself, and does it cheaply too, ultimately impacting the feasibility of mass production.

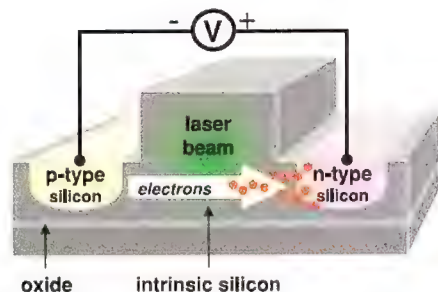
Intel has already achieved this feat, using a series of Star Trekian-sounding technologies including the 'Raman Effect' and 'Two Photon Absorption'. Actually, the latter is an effect observed in quantum physics, and a problem that had to be overcome – but more on this later.



At infrared wavelengths silicon is as transparent as glass and can be used to guide the path of light. Source: Intel

Infinitesimally?

As it happens, this is exactly what they've done.



When current is applied diodes on either side of the waveguide draw electrons to one side to reduce the impact of the two-photon absorption.

Source: Intel

than the loss incurred by travelling through the silicon waveguide.

Researchers quickly discovered that increasing the power of the laser could only go so far before something called 'Two Photon Absorption' got in the way – usually photons travelling through the silicon aren't strong enough to excite an electron in the silicon atoms, which is how the light passes through in the first place. However sometimes if two photons arrive at an atom at the same time, there's enough power for the electron to break free. Although rare, the stronger the laser the more frequently the impacts occur, and while normally the free electrons would recombine with the silicon atoms in the waveguide, with a consistent beam the electrons build up and start to intercept the photons, reducing the effectiveness of the beam.

The solution to this was a pretty clever one indeed – line the waveguide with diodes such that, when its charged, electrons are drawn to one side and allow a focused amplified beam to travel relatively unhindered.

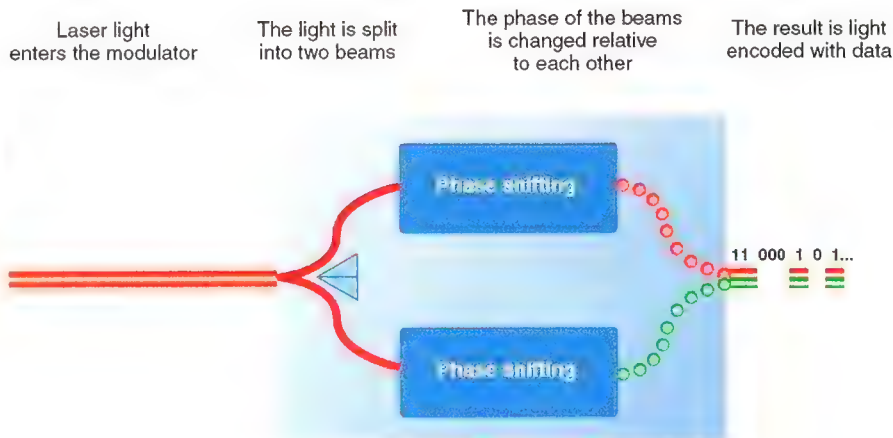
Finally, by coating the ends of a waveguide with mirrors the laser reflects back and forth gaining strength before exiting the cavity in a focused beam – and thus the world's smallest laser is born.

Data at light speed

This, of course, is just one step in the silicon photonics dream – now that we have the laser, there's still the issue of encoding data in it, transporting it and receiving it.

Data is encoded with a modulator to turn the light off and on and produce the 0s and 1s that are the building blocks of computing. This happens at extremely high data rates – and in fact the most recent breakthrough in silicon photonics was the development of a modulator capable of operating at speeds in excess of 1GHz. It sounds small by today's standards, but it's expected that hitting ten or twenty times this won't take long.

To gain these speeds the modulator in silicon photonics works by breaking the beam down into two smaller beams, making one of them out of sync (or out of phase) before merging them together again in a technique known as phase shifting. If you've studied your basic science on waveforms, you'll know that an out of phase signal will cancel out its original source, much



Modulating a beam by first splitting it and then shifting phases before recombining. Source: Intel

like noise-cancelling headphones. When the beams are recombined, out of phase beams negate the source beam and turn it on and off, and thus data can be encoded into bits.

It's at the modulator where the limits of speed and future advances will take place. The faster data can be encoded and read, the more information that can be transmitted per second. However, with the lasers and modulators being mere microns long it's possible to not just improve modulating techniques to increase bandwidth, but to combine many lasers onto a single chip and multiplex the signals for a combined data bandwidth that's also infinitely scalable.

Naturally, waveguides need to exist in silicon to transport the signals and, presumably, optical fibre will be used to transfer it between components in a system. At the receiving end silicon combined with germanium is used in the photo detectors – remembering that silicon is transparent to the light, the germanium increases the silicon's sensitivity to the infrared spectrum and in turn absorbs the light and, ultimately, decodes the signals and passes them on.

Performance

Intel has already demonstrated streaming high definition video using its silicon photonics chip and 5km of optical fibre in real-time with instantaneous playback. So far, while the technology is still in its infancy, it's expected that

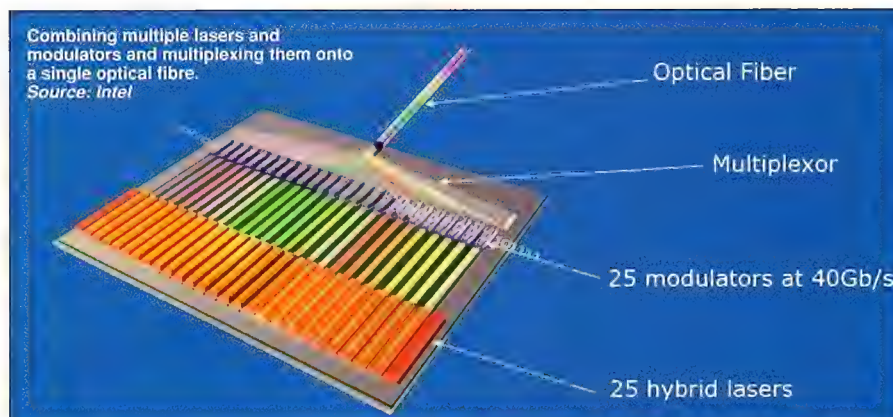
with multiplexed chips data bandwidths as high as 40Gb/s won't be uncommon within a few years.

The full capability of the technology is expected to be in the *terabits* per second category. You think your spanky 1GHz DDR2 RAM is all the rage? Wait until you're running it at twenty times that, and that'll be for *budget* stuff.

“Wait until you're running it at 20 times that, and that'll be for budget memory...”

Well, that might be quite a few years away – we need optical memory, interconnects, controllers and of course CPUs, but it's just a matter of time. The physical properties of metal conductors have real limitations that we're already hitting.

For the first time in the history of computing the future won't be about trying to pump more electrons, but to make the leap from electrons to photons. ©



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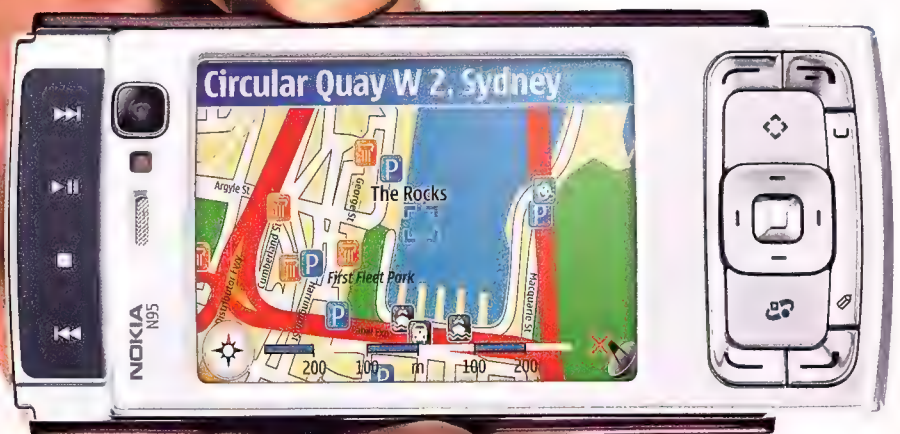
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From the minds of modders

It's the gamers that make the game – literally – says Ashton Mills.

When we got Oblivion here at Atomic it was the hottest thing since Logan's fantasy of Kate Beckinsale and Cameron Diaz wrestling in ice cream. No wait, that's mine. Logan's involves *Warren Spector*, and fairy floss. Don't ask.

I digress – Oblivion was uber impressive, but after a month or so the flaws in its design started to become apparent – chiefly the level scaling system was retarded. And that's being polite about it. Unfortunately the game appeared gimped for the Xbox 360 market, where Bethesda would assume Xbox owners too stupid and lacking patience to play a *good* game.

Maybe that's a fortunate thing, because it triggered a deluge of user-made mods to fix this. And with them sparked new ideas for content and design that went well beyond the initial canvas Oblivion provided.

In fact, I joined them. Starting with a few small mods at first, I soon found myself modding the game more than playing it. And then, I realised, that actually making Oblivion *fun* was going to take time, so I stopped playing entirely.

That was a year ago. Now, after 12 months of gamers fixing and improving the game, it's actually at a point where it's not just good, but *spectacular*, practically a new game. And so I've started playing Oblivion properly, for the first time.

My own contribution – Martigen's Monster Mod (aka MMM) – somehow became one of the 'Big Three' in the community and has garnered some 100,000 downloads. It even has a *Russian* translation, which is just plain cool. I've never had anything (or anyone) in Russian before.

I find it fascinating that not only have user mods made Oblivion worth playing through to the end, but despite how much we might slight Bethesda for the original game, the company also made it possible to produce mods using the construction kit. Today, modding tools have become the de-facto for ensuring a long product life – as a recent poll in the Oblivion forums showed: 85 percent of respondents are only playing Oblivion now, a year later, due to user mods.

For game developers mods keep a title, and just as importantly, a

brand, fresh in the mind of gamers. It usually translates to the bottom line – the Half-Life franchise *still* sells today thanks to the huge range of mods available for it and which are continually developed even if the original titles are not. And as we know some mods *become* the game – Counter-Strike being the perfect example.

It all points to an underlying truth: two minds really are better than one,

so an army of developers (aka modders) that number in the hundreds will, inevitably, produce more content than the developer studio could ever hope to do on its own.

Here in this column a few years ago I proposed a development model that relied on – and in turn rewarded – the almost limitless talent of the gaming community at large. A developer house could employ staff purely to manage would-be contributors and the development of content in an organised way, with Q&A built-in. In return, modders whose work made it into the title would naturally get a copy of the game for free, and maybe more depending on the volume of work submitted. What's a few hundred free copies

compared to being able to expand your gaming world ten-fold? Be it maps, items, enemies, AI, quests, or all of the above. Oblivion is a prime example – the range of weapons and armor in Oblivion is, sorry Bethesda, *embarrassing*. The selection of creatures and their AI laughable. And the levelling system... may it never grace a PC ever again. In short, the vanilla Oblivion experience was the result of what a small development house could make. It pales in comparison to the production abilities of the modding community. Now Oblivion has thousands of new items, hundreds of new creatures, new levelling systems, and a world that actually feels like the adventure Oblivion promised us.

So here's to the modders of all games, for standing on the shoulders of giants.

Ashton is an Oblivion god. No lightning bolts, but he can work up a mean burp.

amills@atomicmpc.com.au



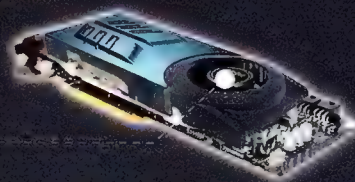
“ People are only playing Oblivion now, a year later, thanks to mods...”



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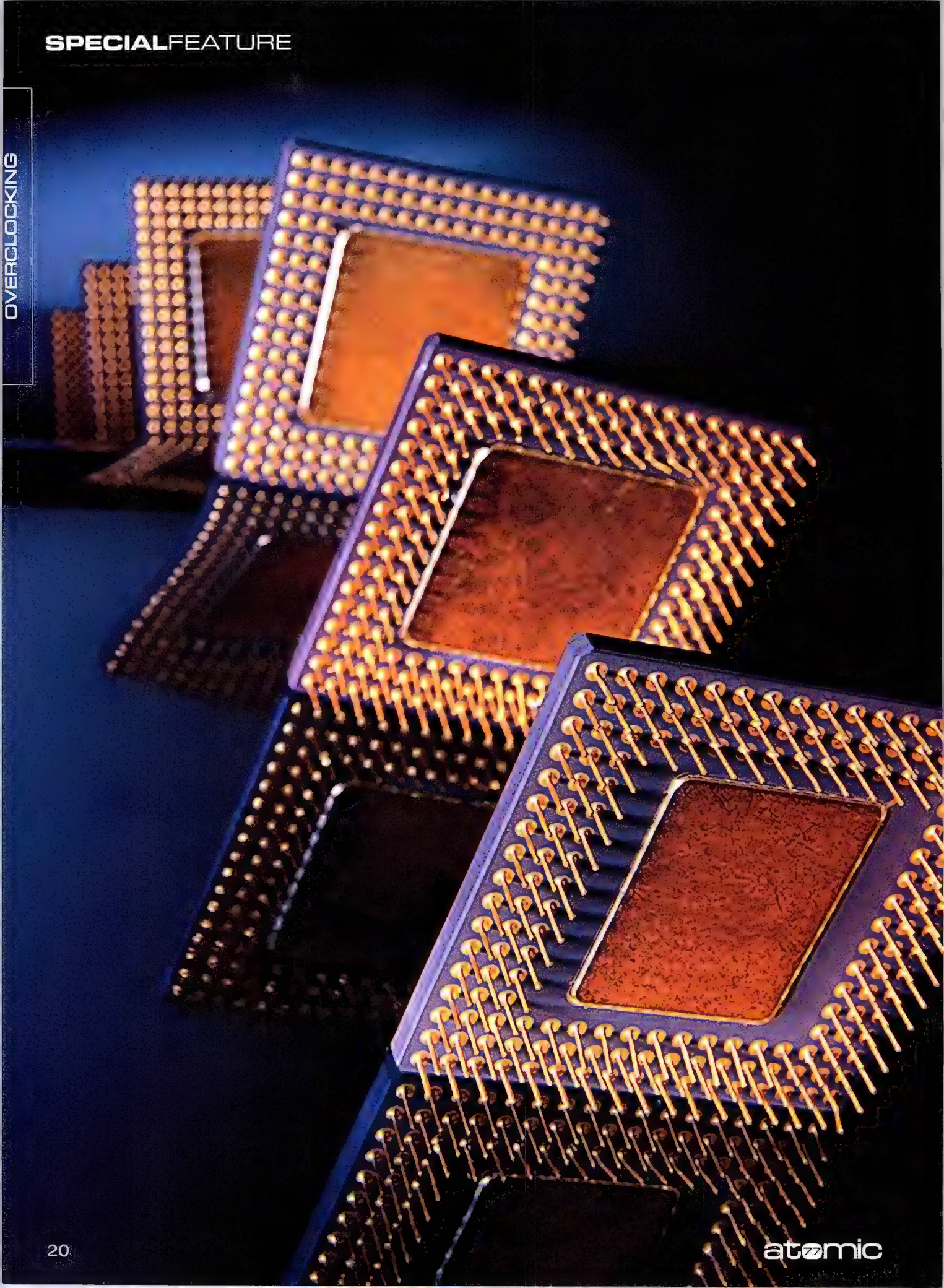
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A History of OVERCLOCKING

PART TWO

Craig Simms still hasn't removed his head from the turbulent past of overclocking. He's heard surgery can fix that.

Last month we looked at the history of overclocking for the desktop CPU from the XT up to the K5 – this month we'll look at everything up to the current day.

6x86

(1997-1998, 0.65µm-0.35µm process, 120-188MHz)

Cyrix does get a mention in our little history for implementing the 75MHz bus on its 6x86 and 6x86MX processors. This meant the PCI bus ran at 37.5MHz, which caused problems with some add-in cards. Cyrix caused even more problems in 1998 when it upped the speed of its MII chip to 83MHz, forcing a completely unreasonable 41.5MHz on PCI. As a result things were unstable, particularly IDE controllers.



The Cyrix 6x86 caused many a problem with both hardware and software compatibility.

K6

(1997-1998, 0.35µm-0.25µm process, 166-300MHz)

The K6 has an interesting history – unsatisfied by its own designs, AMD purchased a company called NexGen, that was developing a chip called the Nx686 at the time. As a result AMD got access to Vinod Dahm, the designer of the original Pentium who had moved to NexGen. AMD changed the design so it would fit Socket 7, included MMX support, and shipped the result. Eventually the PR ratings AMD used were dropped when it started matching the actual MHz of the CPUs. The last ever K6 used Super Socket 7, giving it access to a 100MHz bus. This is the first time AMD used a different socket to Intel, even though it was backwards compatible with other Socket 7 chips. It was a stop-gap solution to up the FSB while AMD was designing Slot A, as it no longer had rights to Intel's sockets. This worked to AMD's advantage – those who invested in a Super Socket 7 board had compatibility with both the upcoming K6-2 and K6-III.

Pentium II

(1997-1999, 0.35µm-0.25µm process, 233-450MHz)

The Pentium II had 512KB L2 cache, separated from the die (hence the need for the large slot-based processor)

which ran at half the speed of the processor. Slot 1 arguably opened up the processor upgrade market, as it was as easy as plugging in a new cartridge and setting a jumper on the motherboard.

While the Pentium II Klamaths (0.35µm) were multiplier unlocked, the 0.25µm part 'Deschutes' had its multiplier hard locked by Intel in an effort to stop dealers selling overclocked processors at a higher price (and, as some have suggested, to protect its high margin market of high-end processors).

Before this, Pentium MMX processors were limited only to their maximum multiplier, so you could downshift, and before that you could choose any multiplier you wanted, within the abilities of the motherboard. This 'locked' policy would not change until Intel released its Pentium 4 Extreme Edition many years later.

This still didn't stop shops overclocking and remarking their processors – PCBs were wired onto



LEGAL FUN

AMD's move from Intel's second-source supplier to standalone chip design firm is an interesting one – it all came to a head during the 486 years, when lawsuits arose and the chip hit the fan.

In June of 1992 AMD was told that it did *not* have a license for its 80287, an FPU based off Intel's design. As Intel had incorporated its FPU into its 486 CPU, this presented a problem for future development.

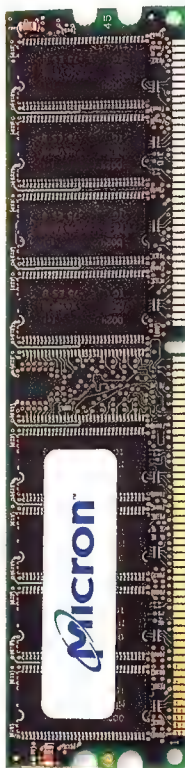
AMD had a license granted for the 386 code, and so it seemed the only way it could progress to the 486 was to simply use the technology on which it had a license and extend it. April 1993 rolled around and in yet another court battle it was decided that AMD did have a license for the 80287, and wallah! The AM486, with microcode from the i486, appeared on the market.

4 June came and another decision was reached – AMD didn't have a 386 license. AMD started to develop its own 486 microcode, although later evidence uncovered high percentages of i386 code.

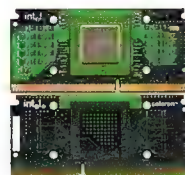
On 30 December 1994, the Supreme Court of California denied AMD's right to use Intel microcode. Immediately after which Intel allowed AMD to use 287, 386 and 486 microcode. Suspect? Perhaps. Intel had its new Pentium weapon to deploy, and AMD had decided to separate itself from the behemoth with its K5.



Intel's Pentium II represented the greatest shift in form factors since the original 8088. It returned back to socket form for the Pentium III.



DIMMs finally meant you could use just one stick of RAM again.



The Celeron 300A without its heatsink. It told the world overclocking was here in a big way, happily hitting 450MHz.

the CPU pins inside the Single Edge Contact Cartridge (SECC) to achieve the job, and as they were hidden with a big plastic block that most people would never open, it was the perfect con job.

While the multipliers could keep ramping on Intel's side, this provided fewer and fewer returning benefits as the rest of the machine simply couldn't keep up with the processor – and so the FSB was upped to 100MHz. This also meant standardised RAM was required, and PC100 Synchronous DRAM (SDRAM) was ratified by Intel.

No longer were RAM speeds referred to in nanoseconds, but MHz, the speed derived from the FSB. PC100 that had passed Intel's certification process could run at 125MHz (9ns memory), allowing a nice little ceiling for overclockers. PC66 was retroactively established to allow cooperation with older Pentium II chips in newer boards. Faster cycle times meant 5-1-1-1 was now possible. These came as 168-pin 64-bit Double Inline Memory Modules (DIMM), and finally only one stick was required to run your system. CAS latency was very quickly reduced from here, and you basically had a choice of C3 or C2 chips, the C2 available for the soon-to-come PC133 standard.

Cooling came stock in two forms – either huge, black-finned heatsinks attached to the back of the SECC or for the faster processors, active-cooling replaced the heatsinks.

AGP was introduced running at 66MHz and provided a dedicated path between the slot and processor, rather than having to go over PCI and compete with other components. The standard would be revised another three times, adding a higher multiplier each time (AGP 2x, 4x, 8x), until its peak bandwidth shifted from 266MB/s to 2133MB/s. Like PCI, AGP was derived as a ratio of the FSB, which could cause issues when overclocking.

It was about this time that the famous ABIT BH6 motherboard was introduced that removed CPU/FSB jumpers from the board, replaced by BIOS settings. The industry noticed and the shift began to BIOS-controlled features. The other advantage of the BH6 was that it completely ignored Intel's FSB auto-select system, allowing you to happily set the FSB to 100MHz on 66MHz certified chips (assuming the chip would boot at this speed). Paired with the Celeron 300A, overclocking had finally become mainstream.

Celeron (1998-2006, 0.25µm-65nm process, 266MHz-3.6GHz)

The original Celeron was a cut-down version of the Pentium II with no L2 cache, but it wasn't until the 'A' revision, particularly the 300A, where overclocking hit with a boom. When it was introduced the Celeron received universal panning from the press due to its lack of cache and hence bad performance, and gave AMD some much needed attention and market share with its K6-2 chip.

The 'A' revision added 128KB of L2 cache back into the mix, but it ran at core speed as, unlike the Pentium Pro, was properly on-die. No longer limited by slow L2 times, overclocking improved massively with the 300A hitting 450MHz regularly when switched to a 100MHz bus from its default 66MHz.

By the time of the A revision, Celerons were circulated in both Slot 1 and Socket 370 form. As the cache was on-die, there was no need for the slot form factor, and the SECC cartridge was discontinued in 1999. The Celeron line continued to be cache-cut versions of Intel's higher performing chips until the Pentium D was released in 2005, where it was sold single instead of dual core.

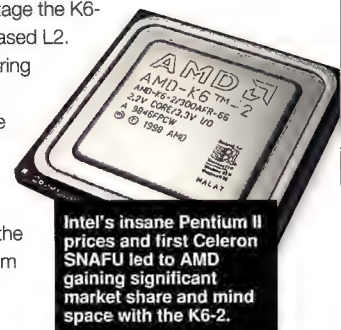
Also introduced was the slotket – a circuit board that could be plugged into a Slot 1 board so it could support Socket 370 chips. This came about due to lengthy delays in getting the Socket 370 standard to market.

In 1998 a program was released called SoftFSB by H.Oda. SoftFSB allowed the PLL controlling the FSB to be manipulated directly through Windows, essentially allowing FSB tweaking on the fly. This was especially useful for those who didn't have FSB tweaking options in their BIOS, however it came at a price – no ability to set AGP and PCI ratios. As both buses were divided from the FSB, any FSB increase meant that these went faster, leading to potential crashes. There would be many software programs like this over the years. The one enjoying the most popularity today is called SetFSB – as usual though, only limited PLLs are supported.

K6-2, K6-III (1998-2000, 0.25µm-0.18µm process, 266-550MHz)

K6-2 was AMD's answer to the Pentium II, although once again a little late. 3DNow! was introduced – a SIMD set that increased the performance of 3D applications to make up for the weak FPU. It became a popular alternative to the early cacheless Celeron, and remained popular in the face of the cache-enabled Celeron due to excellent price/performance. At this stage the K6-2 still relied on slower motherboard-based L2.

The K6-III came along in 1999, offering a 256KB on-chip L2 cache, and the motherboard mounted cache became L3. Upon its release, the K6-III was the fastest desktop CPU – something AMD would get used to in the coming years. Intel quickly put the Pentium III to market, a refined Pentium II architecture that allowed for higher clock speeds.



Intel's insane Pentium III prices and first Celeron SNAFU led to AMD gaining significant market share and mind space with the K6-2.

Pentium III (1999-2003, 0.25µm-0.13µm process, 450-1000MHz)

The Pentium III would be Intel's last solid hold on the market until Core 2 Duo. With it was introduced the first edition of Streaming SIMD Extensions, or SSE. To this day, SSE versions remain one of Intel's strongholds, AMD usually only gaining compatibility a revision later.

Certain 450MHz SECC2-slotted Pills could hit 600MHz without breaking a sweat, the new cartridge allowing the CPU to have direct contact with the heatsink. The race for the gigahertz became real.

The 'Coppermine' revision was released, returning to socketed processors using a FC-PGA package for Socket 370. For the first time, people started caring about what kind of heatsink was fitted on their CPU, with companies like Globalwin, Alpha and Thermalright coming to the fore. These were typically a pain to install, and were skull-crushingly loud to keep the CPU tamed at default speed, let alone overclocked. People began to talk about thermal interface material, and Arctic Silver became a household name. Cache was shifted on-die to compete with the K6-III and Athlons. As speeds ramped up to the GHz a third revision, 'Tualatin', was released.

Dividers and ratios began appearing to keep the PCI bus, AGP bus and RAM happy in the face of the different FSB speeds available (66, 100 and 133MHz).

Near the end of its life the Pentium III introduced what would be one of Intel's worst decisions – RDRAM. While offering double-pumped frequencies (like DDR) and dual channel architecture (effectively doubling data throughput by teaming two 64-bit data channels to create a 128-bit bus – this would later be expanded to quad channel), RDRAM was hideously expensive, suffered latency problems, and Intel's agreement with Rambus meant that its platform would use it exclusively – turning people to the AMD

SDRAM/DDR alternative. It also signalled a return to the bad old days of populating all slots, with RIMMs needing to be paired, and every RIMM slot needing to be filled – a passive device known as a continuity RIMM had to be installed in the empty slots to make things work.

Over the years Rambus generated a lot of bad press, and eventually Intel separated itself from RDRAM in the latter half of 2003. This would be the first admission of many that AMD was on to a good thing.

Athlon, Duron (1999-2005, 0.25µm-0.13µm process, 500-2330MHz)

AMD's seventh generation CPU finally got a strong FPU and was incredibly fast. Starting as a Slot A processor similar to Intel's Slot 1, it was the result of AMD hiring DEC engineers and consequently gaining the benefits of the high performance Alpha architecture, notably the EV6 bus.

The biggest benefit of the EV6 was it was Double Data Rate (DDR), meaning that while the clock only had to beat 100 times a second, it was interpreted as 200MHz.

The Slot A Athlons were the first from AMD to be multiplier locked, due to the same dodgy resellers that plagued Intel.

The Internet arguably hit its biggest boom and enthusiasts worldwide traded ideas through hardware websites. The Athlon became the choice of the enthusiast. Insane hardware modding began and unsoldering and resoldering specific resistors to the Athlon resulted in the multiplier being unlocked. This would eventually transform into an off-the-shelf solution called 'Goldfinger', which attached without solder to the gold circuit connector at the top right of the Athlon, offering either dipswitches or dials to set the multiplier – unfortunately these solutions didn't offer access to the L2 cache divider like the earlier homebrew attempts.

AMD shifted to a socketed solution (Socket 462, or Socket A) for its second revision chips, codenamed 'Thunderbird'. It was here that AMD won the speed battle, releasing the first GHz processor and taking serious market share from Intel due to significantly better performance per clock. Socket A would continue to be used until the Athlon 64, something that appealed to upgraders over Intel's constant socket-switching shenanigans.

Socketed Athlons were multiplier locked by laser etching the CPU itself, with traces being removed from the surface between four sets of contact points, known as the L1 bridges. Amusingly, people reconnected these with a mere pencil, unlocking them once again.

Later locks would involve a trench being burnt into the CPU to mitigate this – so people simply filled the trench with a non-conductive material and whipped out the old 2B once more.

AXIA-revision Athlons became as famous as the Celeron 300A for overclocking headroom. The AMD age had arrived.

The Duron was released to compete with the Celeron, the fantastic price versus performance making it the gamer's choice. Its only distinction from the Athlon was having a quarter of the L2 cache at 64KB, and was limited to 100MHz bus speeds initially when the Athlon hit 133MHz.

The Athlon XP came in late 2001. It was SSE compatible, and on average 10% more efficient than the Thunderbird at the same clock, and re-introduced AMD's PR rating. People began to understand that MHz wasn't everything and instructions per clock were more important. AGP 8x became common.

Unlike the Pentium 4, the socketed Athlon's core was exposed, with no heat spreader to protect it from a heavily ratcheted-down heatsink – as a consequence, many cores were crushed to death.

VIA became a force in with its KT133A and KT266A chipsets for AMD, although numerous compatibility problems arose,

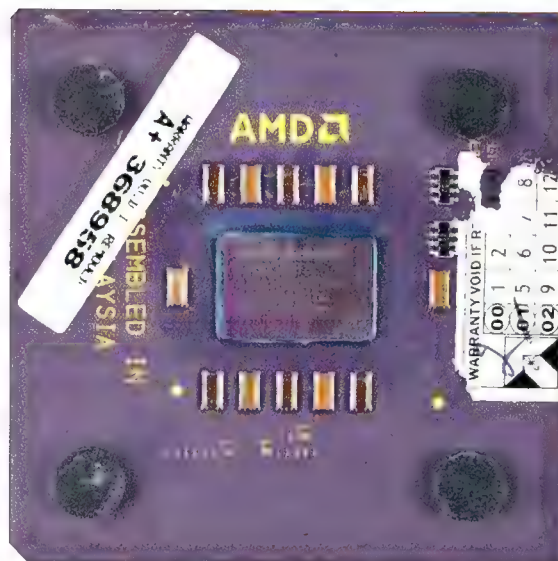
particularly due to PCI bus latency. Several homebrew tools popped up to fix the issues. The latter chipset brought DDR RAM into the fray, thanks to VIA's excellent memory controller. Before this point, DDR was only marginally faster than SDRAM and a whole lot more expensive.

NVIDIA entered the market with the nForce, but it wouldn't be until the nForce2 that people would take it seriously, thanks

to the dual channel RAM support, SoundStorm onboard audio, dropping of the integrated GPU and the stability of the platform compared to the VIA alternative. NVIDIA rapidly expanded to be one of the biggest players in the market, arguably popularising the integrated approach on the motherboard. Motherboards appeared that ignored AMD's multiplier lock.

RAM ratios became more prominent, allowing greater control over how they were divided from the FSB, particularly in boards offered by DFI.

The Athlons famously ran hot, requiring even louder coolers, but they'd be nothing compared to Intel's alternative...



AMD's Athlon could be multiplier unlocked by a mere pencil. The AXIA Athlon was a famed overclocker.

Pentium 4 (2000-2006, 0.18µm-65nm process, 1300-3800MHz)

Bear with us here – the Pentium 4 changed so much over its tenure that there's barely enough room for history, let alone overclocking.

The first Pentium 4 was by all accounts a flop. It was the first architecture redesign since the Pentium Pro and introduced a deep pipeline called NetBurst in the hope that massively ramping clock speeds would overcome the latency. Pentium IIIs at the same clock speeds would outpace it.

While speeds climbed fast initially, soon the 3GHz barrier was hit, and things progressed slowly up to a final 3.8GHz – far short of the 10GHz predictions. The Pentium 4 was notoriously hot throughout its lifetime, requiring exotic cooling solutions. SSE2 was introduced, but short of video encoding didn't seem to offer huge benefits.

Motherboards required a 20-pin power connector like the Athlon alternative, but also needed a 4-pin EPS12V connector and a 6-pin auxiliary connector – it was one power hungry beast. In fact so many new parts were required compared to AMD's platform (PSU, RAM, in some situations a case, as early HSFs were recommended to be bolted to the chassis itself) that it turned people away. The problem compounded when it launched on Socket 423, but quickly transitioned to Socket 478, burning early adopters.

AMD's platform may have been double-pumped, but Intel's was quad – resulting in an initial effective FSB of 400MHz compared to 266MHz. Thermal throttling was introduced, the processor slowing itself down if it got too hot. Overclockers instantly turned it off.

The Athlon XP solidified AMD's lead.



2002 saw the introduction of the 130nm, 533MHz FSB Northwood revision, which put Intel back in the race against AMD's Athlon XP, although it required higher clock speeds. The Northwood 1.6A was released in June 2002, which reached a thumping 2.57GHz when we overlocked it.

RDRAM was finally dumped and SDRAM was enabled on the 845 platform in 2002, with DDR following in 2003. By this stage DDR prices had crashed, the significant price reduction invigorating the Pentium 4 market. It was VIA however that was first with a Pentium 4 DDR board with the Apollo P4X266, despite Intel's complaints that it was not licensed to make chipsets for its processor.

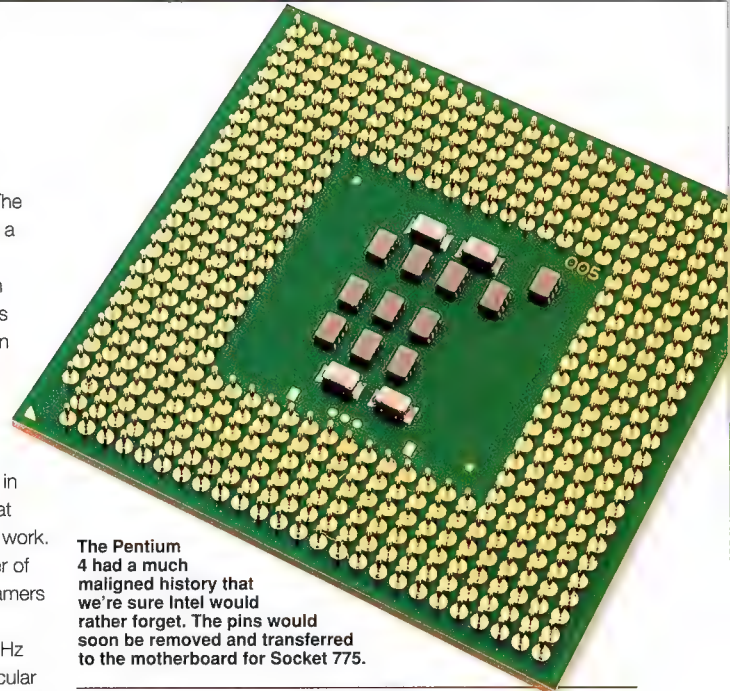
HyperThreading was introduced with the 3.06GHz model in November 2002, allowing one core to process two threads at once – this was done by allocating idle execution units extra work. In theory this was meant to speed things up, but in a number of situations actually slowed the processor down, and many gamers simply turned it off.

Northwood finished at 3.4GHz in early 2004, on an 800MHz bus, but the overclockers did better. The C1 revision in particular gave 3.5GHz from 2.2GHz, and there were reports of 4GHz from the 3.06GHz models.

The Pentium 4 Extreme Edition hit the market with an unlocked multiplier, opened for the first time since the Pentium II. An L3 cache of 2MB was added for an extra speed boost, and it ran on a 1066MHz bus.

The Prescott revision came in 2004, and despite being shrunk to 90nm would run hotter than ever before, with the Northwoods outperforming it clock for clock in most games – only SSE3 and extra cache saved it in applications. AMD would take the lead once more with its Athlon 64.

It was at this point that Intel shifted to Socket 775, DDR2, PCI Express and upped the bus to 800MHz. DDR2 was a long term investment, being slower than DDR at the time. A strategy began similar to what AMD implemented with Socket A – we would still



The Pentium 4 had a much **maligned history that we're sure Intel would rather forget. The pins would soon be removed and transferred to the motherboard for Socket 775.**

have Socket 775 three years later. PCI Express finally rid us of the PCI and AGP buses, running at an asynchronous 100MHz.

The idea of PR ratings was borrowed from AMD, although it seemed more to hide the fact that high GHz didn't equate to high performance. The 4GHz mark was never officially reached, Intel going down the dual core route instead. Prescott was eventually revised to include 64-bit instructions (sporting AMD 64 compatible code called EMT64, another concession) and virtualisation technology.

The 65nm Cedarmill was the final incarnation of the Pentium 4. It reached 3.6GHz and was most notable for hitting the highest frequency ever – 8GHz – a world record overclock yet to be beaten. LN2 was used, along with motherboard voltage mods to achieve the massive speed.

Athlon 64, Athlon 64 X2 (2003-present, 130nm-65nm process, 1800-3000MHz)

AMD's response to the increasing Pentium 4 challenge was to get 64-bit to the desktop market first, but with 32-bit compatibility as well. In September 2003 the Athlon 64 came, and AMD architecturally diverged from Intel again.

The memory controller had been taken off the northbridge and incorporated into the CPU, which reduced latency remarkably. One unfortunate side effect was that it would also be subject to whatever voltage you fed the CPU – this wouldn't be fixed until the release of Socket AM2+.

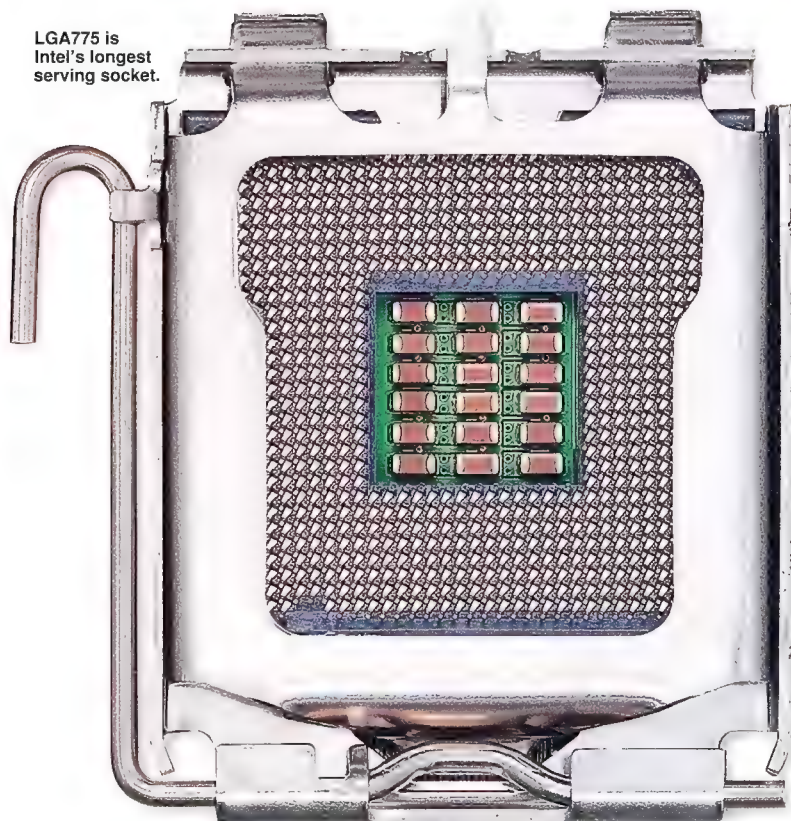
As such, the FSB no longer existed and was replaced by the HyperTransport bus (HTT). This originally ran at 200MHz, and was pumped by an HT multiplier (originally called the LDT, after HyperTransport's original name of Lightning Data Transport) of up to 4x, giving an effective 800MHz bus. Since this was a DDR system, this would give an effective speed of 1600MHz.

The general rule of thumb among overclockers was to keep the expected HyperTransport frequency the same – so if you were meant to run on a HyperTransport frequency of 1GHz and needed to ramp the HTT, you dropped the HT multiplier accordingly. In fact it was recommended at first to stay under the recommended HyperTransport frequency due to stability issues with early motherboards. The nForce3 in particular kept the multiplier at 3x for this reason.

A heat spreader was introduced to the CPU so cores would no longer be easily crushed.

The nForce3 allowed the the PCI and AGP buses to finally be decoupled from the FSB, so they could run at a native 33MHz and

LGA775 is Intel's longest serving socket.



66MHz – although this would be slightly broken until its second generation. This same advantage would crop up in the Pentium 4.

The Athlon 64 allowed the CPU multiplier to be bumped down, meaning HTT could be ramped brutally within the limitations of your RAM.

To compete with Intel's Extreme Edition the Athlon FX was released. The only difference from normal chips tended to be a slightly higher clock speed and an unlocked multiplier – although the first FX chip required buffered memory.

The Athlon 64 started on Socket 940 for the FX and Socket 754 for the desktop edition, but in remarkably Intel-like behaviour this was quickly shifted to Socket 939 (bringing dual channel memory and a HyperTransport bus increase from 800MHz to 1GHz courtesy of a 5x multiplier) six months later for desktop, while 754 was relegated to the new Sempron, essentially the replacement Duron. The FX would stay on 940 for a while, but this would be revised to use unbuffered memory – and would eventually transgress to the 939 platform. The nForce4 was released offering PCI Express, and as a consequence SLI was reborn.

Tower HSFs became popular such as the Scythe Ninja, and would approach 1kg in weight – the 120mm fan significantly quieter than the howlers of old. Suddenly we were no longer willing to accept excruciatingly loud coolers in the name of overclocking – they had to be quiet too.

Venice and San Diego revisions were released at 90nm, which featured SSE3 (the original Athlon 64 supporting SSE2 only) and an overhauled memory controller.

In 2005 AMD released the X2 – the first dual core CPU. It was released at around the same price as high-end single core chips, while the single core prices dropped, assuring quick adoption. All things seemed rosy, and in 2006 AMD released Socket AM2 Athlon 64s, its major advantage being DDR2 support and virtualisation. This would prove to be underwhelming in the face of Intel's mighty comeback, which started with a small processor called 'Core' on the notebook platform...

Pentium D (2005-2006, 130-90nm process, 2660-3730MHz)

To fend off the X2 attack, Intel released the Pentium D, codenamed Smithfield. HyperThreading was disabled on all but the Extreme Editions. Initially released at slower clock speeds than the Pentium 4, the low-end Ds were heavy overclockers, the Prescott architecture they were born from finally showing maturity. This would be followed by Presler, using two Cedarhill cores, which also showed good overclocks.

Intel was finally starting to outperform AMD again in some areas, and the rumbling rumours of a chip name Conroe were starting to be felt.

Core 2 (2006-present, 65nm, 1060-2930MHz)

Conroe became Core 2 Duo, and Intel bit back hard. Clock for clock Core 2 seriously outperformed the Athlon 64, and saw the retirement of the thirteen-year old Pentium name. A complete redesign, the majority of Core 2 chips ran at 65W rather than the previous 130W, allowing for plenty of overclocking headroom in the heat stakes.

Core 2 operated on a 1066MHz bus, although an 800MHz budget edition was later released. Called the E4300, it happily reached Extreme Edition speeds of 3.0GHz from its original 1.8GHz by ramping the FSB. People started getting stable FSB overclocks close to 500MHz – that's an effective 2000MHz bus speed – as the Intel and DDR2 platform reached maturity, in no



The Athlon 64 X2 brought dual core to the masses, and the masses said 'Thank you'.

small part thanks to the P965 chipset.

AMD bought ATI, in an effort to compete with Intel at the platform level. This would result in a big slow down as the companies attempted to integrate, ATI's DirectX 10 part 'R600' being delayed many times.

NVIDIA and Intel just smiled.

At the same time AMD tried to counter with its '4x4' concept, aimed at enthusiasts and would require FX chips. After a lot of FUD (Fear, Uncertainty and Doubt) it was revealed to be nothing more than a workstation board that didn't require ECC memory, and was released eight months too late by a single vendor using the nForce 680a platform, to the fanfare of a single mouse squeaking. No one else noticed.

Before this NVIDIA released its 680i board, for the first time offering RAM speeds unlinked from the FSB – although this was simply implemented as a huge array of ratios hidden from the user. Still, this allowed greater overclocking flexibility than ever before, as RAM was no longer as crucial a component in the process.

Determined to press the advantage, Intel dropped prices rapidly and released quad core chips. The benefits were spurious to the home user, however they retained the overclocking capability of their Core 2 heritage. Not finished with digging the boot in, Intel announced its 45nm process, with no doubt even more overclocking headroom.

The future

Well there we are – a (not so) short history of overclocking up to this point in time. If you missed the first part, be sure to grab a copy of last month's issue (*May #76*).

Now that you understand the development of the CPU, you can see what's going on when you overclock and how the systems that have been implemented over time have matured to get us where we are.

Interestingly, methods of cooling haven't changed much – they have simply become more accessible to the public. Air, water/coolant, peltier, phase change and LN2 cooling have all existed for quite some time – although admittedly they have been refined.

There are numerous other avenues that could have been pursued throughout the course of this article, but if we followed all traces, forum posts and offhand references we'd be here until the word 'CPU' had no meaning.

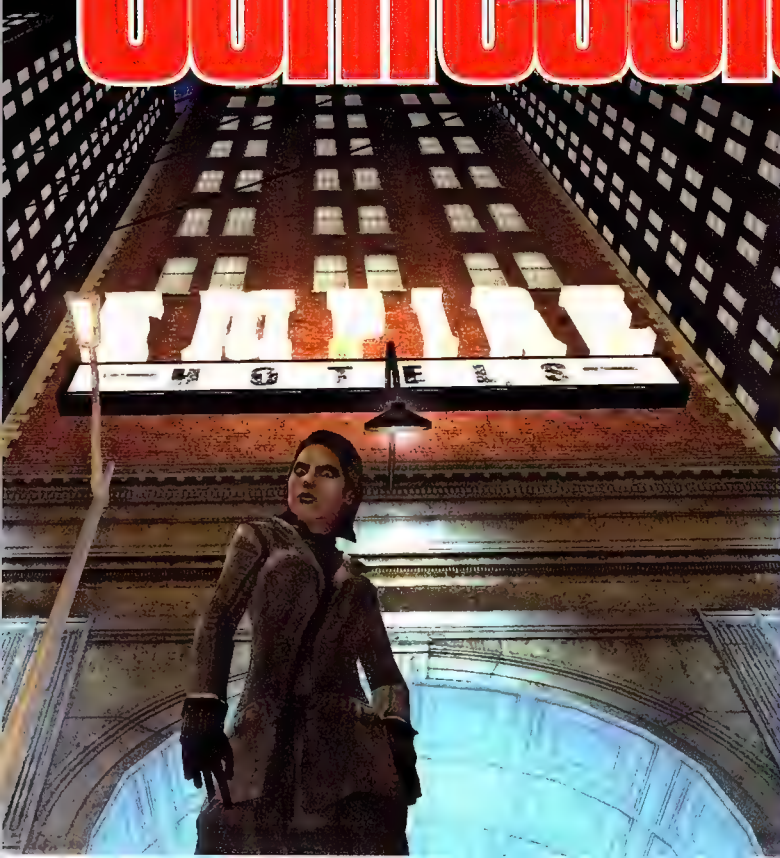
Which probably isn't that far away, considering the inexorable march of general purpose GPU... 

REFERENCES

For all references used in this article, please check www.atomicmpc.com.au/overclockhistory

Alexander Gambotto-Burke spoke with Richard Garriott, Chris Avellone, Joel Billings, Todd Howard and more on the struggles of working in the genre of the role-playing game

Confessions of an





RPG DEVELOPER



Genre names tend to be short and sweet. 'First-person shooter' doesn't leave too much to the imagination, 'Turn-based strategy' gets the point across, and you can almost smell the pearls of sweat dripping from the receding brows of furtive postal workers when you hear the words 'Adult game'. But for a genre that holds court over so many passionately loved and respected games, 'Role-playing game' doesn't mean much at all. Even Tetris casts you as a sort of invisible actor – the mysterious, god-like being who can spin falling shapes around at will. Realistically, if we are going to go all OED on the RPG, any game would conceivably feature a bit of 'role-playing'.

Unsurprisingly, various games have laid claim to the title. From odd FPS hybrids like *Ultima Underworld* to colour-by-number games such as *Pool of Radiance*, the RPG has reigned over a variety of weird and wonderfuls. There are those, though, who think they can close the case: Richard Garriott (or 'Lord British' to the initiated), for instance. The 45-year-old creator of the legendary *Ultima* series and upcoming massively multiplayer online game, *Tabula Rasa*, is certainly the sort of fellow whose number you'd dial when such questions arise. After all, he helped shape the RPG into what it is today.

'I think, fundamentally, a "role-playing game" is best defined by the first word,' he says, 'in that it's a game where you play a role. This means that when you sign up and begin playing the game, and you choose or are given a role, your success or failure is dependent upon how well you play that specific role. For example, one of my favourite role-playing games – as I know them – is *Thief*, which was made by some of my friends here in town. In that game, you're clearly playing the role of a thief; if you don't play that role properly, you won't succeed. What's interesting is that I think most



Most people who are building RPGs are building statistics and inventory management games...

people who build role-playing games don't adhere to that; for those, I actually use a term that means the same thing: "RPG". Which of course really just means role-playing game, but I use that acronym to describe more of what I see in the industry. For example, most people who are building RPGs are building stats and inventory-based management games.

These are where, in order to get through the game, you collect treasure and pump attribute points – you optimise your damage over time, and improve your defensive strengths to succeed at the challenges placed before you. And I think that's actually considerably different to a true "role-playing game". I think most people in this business don't really split hairs like that, but there are actually very

Below: Richard Garriott demanded that the Avatar follow a strict moral code, as well as be a hero.



few games that could be called "role-playing games", that focus very much on how well you play that role, or how much they encourage you to live through that role. It's more about attribute management.'

Birth of the RPG

Reflecting on Garriott's thoughts about the genre, one has to wonder: If even the arguably most important force in the evolution of CRPGs can't quite draw a perfect circle around what it is to be a role-playing game, what hope is there for anyone else? In order to explain the different philosophies about RPGs, it might be an idea to return to the source: Dungeons & Dragons. D&D, as it's more commonly known, is a tabletop role-playing franchise first published by TSR in 1974. The premise was that you'd roll (create) a hero using a statistics sheet, and go out into either pre-written campaigns – offline versions of CRPGs, in other words – or ones developed by your friends on-the-fly. Due to the amount of control players had over the game, it was hugely dynamic and provided a sense of freeform adventure that computer games have yet to replicate. This is the side of D&D that inspired Garriott to create Akalabeth in 1979.

Garriott fondly remembers the beginnings of his empire: 'When I was writing Akalabeth back in high school in the late '70s, there were very few computer stores, and there were very few national distributors. And the state-of-the-art for game packaging at the time was a Ziploc bag, Xerox coversheet and hand-copied discs. I was working in the summer after my senior year in high school at a computer store, and it was actually the owner of the Computerland store where I worked who said, "Look, Richard, the game you've made here after school in the evenings at the store is considerably better than the games we've got on the wall here; you should sell this."

So, the future Lord British went off to gather the items he thought were needed to ship a successful game: Ziploc bags and Xerox coversheets. He spent \$200 – a seriously big deal for a teenage Garriott – to buy them. 'I hand-printed the discs,' he remembers, 'and sold them on the peg-board of the Computerland store. And I think within a week of selling them there, I got a call from one of the only existing Coast to Coast distributors. They said, "Hey, Richard, we've got a hold of one of your games; we'd really like to publish it nationally. What do you think?" So I signed a contract with California Pacific, they put it in a bigger Ziploc bag, raised the price from \$19.95 to \$34.95, and sold 30,000 copies. My royalties were \$5 per unit, and if you do the math, that's \$150,000 for my after-school project. What took me six weeks of after-school time ended up making me double my Dad's government salary as an astronaut. "Clearly," I thought, "this is a good idea."

So I immediately began working on refining Akalabeth, because, you know, there's no story in Akalabeth; it's just walking through dungeons, fighting monsters and collecting treasure. And I knew if I created a game with public consumption in mind, I'd make something much better – that's how the Ultima series began.'

Garriott more or less fumbled around for the first three Ultima installments, creating great, but undeniably eclectic



and unfocused, games. It wasn't until 1985's *Ultima IV: Quest of the Avatar* that he really started developing what he now calls 'role-playing games'; before then, they were plain old RPGs. In *Ultima IV*, you would succeed based on your adherence to Garriott's fictional moral code – the TLC system – and breaking those rules (a possibility thanks to Garriott's pursuit of non-linearity) had dire consequences. Garriott took what he could from D&D – the open storytelling, the world, even a version of the alignment (good/evil) system – and forged an infinitely popular and influential RPG series.

The other way to skin a cat

There are those, though, who were inspired by D&D in a different way. Where Garriott admits in his high school days that he found strict adherence to the die-rolling and statistics management side of D&D incredibly tiresome, Joel Billings, former CEO of SSI, thinks it was the tactical side of the game that made it so compelling. And when his company released the Gold Box D&D games to unprecedented commercial success, he was vindicated. A die-hard wargamer at heart (growing up in a family of veterans tends to do that to you), Billings was never too roused by Elves, Orcs, and magic arrows. It wasn't until Paul Murray and Keith Brors – designer and programmer of SSI's first Gold Box hit, *Pool of Radiance*, respectively – pointed out the tactics involved in D&D that he took interest. 'Most of the games that were out while we were doing *Pool of Radiance*, like *Ultima*,' Billings remembers, 'were, you know, more that sort of, "One guy wanders around the world" adventure games. And what Paul had done a little differently with one of our RPGs before *Pool*, *Wizard's Crown*, was tactical combat – more like a war game, you know? You had your party, and you'd go into battle, and you'd move the pieces around.'

If you're of the Garriott school of thought, you might find it a little surprising that SSI's vision of RPGs followed the D&D structure much more accurately than *Ultima* ever did. This was probably helped by the fact that SSI was the first D&D licensee in the games industry, but more important was the Gold Box series' dedication to tactical combat. 'I think what we were doing was much more like pen and paper D&D,' Billings argues, 'because, when you think about it, TSR was originally called Tactical Studies Rules – they later became TSR. And that's because Gary Gygax created a miniatures rulebook to do combat, and then they wrapped all the

role-playing stuff around it. That's my understanding of how D&D came about. So it was really a tactical miniatures game, at least initially. And that's what Paul and Keith really liked. So we had the expertise in that field, and we showed them we could do it.'

And, it would seem, the tactical features in the Gold Box games were exactly what gamers were looking for. 'D&D and all the other miniature systems that were out there really had the tactical combat,' Billings notes. 'You sat down, and you had your miniature piece, and you'd go into combat. You didn't really see that in games. We gave them that.'

If it was SSI that paved the way for the supremacy of D&D-style gameplay over the RPG scene throughout the '90s, it was Garriott and his Origin pals who gave the genre its soul. Now almost a given in top-tier RPGs – particularly those made by BioWare and Obsidian Entertainment – moral and accountability systems were nonexistent in games before Garriott found the ethical honey pot. And, contrary to the popular opinion that deep games sell like positions at Gary Glitter daycare centres, *Ultima IV* – the first in the series to implement such a system – outsold all the previous *Ultimas* by a very large margin. In that game and all subsequent *Ultimas*, you weren't just judged on how well you slaughtered the end-boss; the way you treated those around you affected your reputation as a hero.

Garriott explains why such gameplay mechanics are important: 'If you look at most of the greatest works of classical literature, the most compelling stories often do use a classical story arc you might have read about. You know, where you have the hero's journey, where the main character starts off as someone who's weak or has a personal flaw, and who'd be the unlikely person to face the great challenge in the story. And, of course, through perseverance and personal growth, not only do they save the universe or whatever, but they also grow internally. It's a powerful story, and you identify with it a lot – it's also very useful when making good game stories. So I think that games that don't focus on personal growth and change are missing out on an opportunity to create something that isn't just fun, but also meaningful to the players – lasting fun. And it will become nearer and dearer to their hearts as time goes on. It's more than just, "Hey, man, this is a good distraction for the next hour." It's, "This is something I enjoyed on a very deep level."

Later *Ultima* titles took this even further. *Ultima V: Warriors of Destiny* (1988), for example, highlighted the flaws in fundamentalist philosophies and

Above The visuals of *Neverwinter Nights 2* far exceeded those of its predecessor.

Above centre *Ultima Online* launched massively multiplayer online RPGs into the spotlight.



authoritarianism through a complex, cleverly-paced storyline; Garriott's moral system served as the benchmark on which all characters and ideologies were judged. It was a new way of creating heroes and villains in the games; where once all you had to do to be the bad guy was dress in black, own a dungeon, and scowl like Steve Bing passing a kidney stone, now your actions had to reflect Garriott's model of evil.

The next two Ultima games – The False Prophet (1990) and The Black Gate (1992) – expertly took advantage of this new mechanic. The first dealt with issues of racism and xenophobia with allegory; the second focused on deceitful evangelism and religious manipulation. Garriott maintains that his greatest contribution to the RPG genre was developed in these games and their predecessor, Ultima IV – collectively known as the 'Age of Enlightenment' trilogy.

'I think my main contribution,' he muses, 'was that attempt to create a virtual world that had a level of depth and meaning beyond simple diversion. And what's interesting is that when I first started down that journey in the mid-'80s, I wasn't sure how well it would work at all, and whether the player would appreciate it or simply reject it because they didn't desire an educational layer in their gaming. Of course, Ultima IV ended up outselling all its predecessors and jumped up radically. It quickly became the foundation on which all the later Ultimas would be based. You know, it started a new trend in RPGs – there are many RPGs coming out now where you don't just choose your class and abilities; you actually go through little ethical parable tests at the beginning, in order to do a personality test on you to suggest a role. And I think the fact that people have picked that up and followed in its footsteps implies the value I've brought to the genre.'

With the later Ultimas, Garriott not only showed the world that traditional fantasy could deal with complex themes, but that videogames as a whole were capable of being just as philosophical, provocative, intelligent, and stimulating as other artforms. Origin seemed invincible; by the time The Black Gate was released, Garriott (and the world) knew he'd made his best game yet. But trouble was on its way, and its name was EA.

Bigger picture

We're getting ahead of ourselves. While Garriott was off injecting philosophical and moral depth into videogames, the RPG genre continued to advance in different directions. A year after Quest of the Avatar hit shelves, New World Computing released the first chapter in its highly influential Might and Magic series, Might and Magic: The Secret of the Inner Sanctum (1986). Featuring a ridiculous number of NPCs, monsters, and treasures, and much more importantly, a vast, open world to explore – well, as 'open' as tile-based, maze-like graphics could allow – M&M arguably became the first torch-bearer for open-ended RPG design. (Said torch would be passed on to the far more successful Elder Scrolls series just shy of ten years later.) And, as an interesting contrast to M&M's

Above While Troika's Vampire: Bloodlines was a critical success, it failed to save the struggling developer.

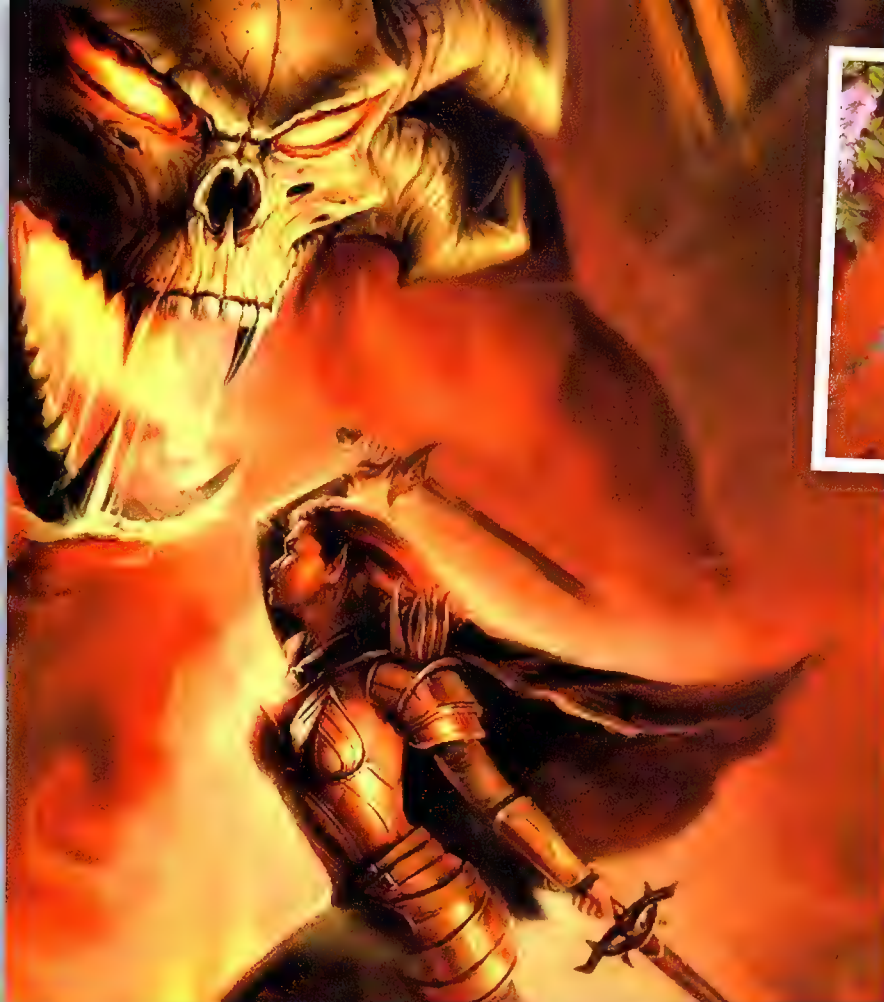


We did it because we were trying to keep in good with TSR. It wasn't necessarily because we thought Buck Rogers was going to be this big thing. We sort of went along with it.

fluffy fantasy, Interplay Productions released Wasteland (also '86), the game that would go on to inspire Interplay's later hit and one of the greatest CRPGs ever made, Fallout. Set in a post-apocalyptic Nevada, Wasteland had players venture out into an inhospitable desert, fighting hideous mutants and working alongside NPCs whose goals often conflicted with theirs.

And then there was SSI. The small company was enjoying incredible success with the release of each Gold Box title – Pool of Radiance (1988), Curse of the Azure Bonds (1989), Secret of the Silver Blades (1990) – all the while pausing occasionally to develop wargames and take on other RPG franchises. The weirdest? Buck Rogers. The ancient comic strip hero had recently made a comeback with TSR's Buck Rogers pen and paper setting, and, as TSR was under new management, SSI was tasked with making a game none of the D&D-playing crew could have ever expected.

'That was TSR's decision,' Billings laughs. 'The woman who owned TSR at the time, Lorraine Williams, was the granddaughter of the creator of Buck Rogers. And when she bought – well, basically, she took control of the company in a very interesting power play with Gary Gygax. She sort of bought the company out from under the guy one day; it was real Machiavellian stuff. Anyway, she ended up owning the company outright, and wanted to bring Buck Rogers back, because of her family history; that's where her family's money came from. We did it because we were trying to keep in good with TSR. It wasn't necessarily because we thought Buck Rogers was going to be this big thing. We sort of reluctantly went along with it, and had we ever done it over again and known that the D&D thing was going to go away, we probably wouldn't have done the game. Although we thought it might keep them happy for



a while longer, ultimately, we didn't go any longer with the license than our contract allowed us. So we just took the Gold Box engine and slammed out a clone.'

If Billings' cynicism is any indication, it should be fairly obvious that the relationship between SSI and the company that sold it the winning D&D license was beginning to fester. Before the Gold Box empire truly fell, though, the company published a very interesting property – the first graphical MUD, the Gold Box-based *Neverwinter Nights*. MUDs had first appeared on college mainframes in 1977, and grew in popularity throughout the '80s as online spaces where players over the world could participate in one giant RPG – basically, the first MMORPGs. Until *NWN*, though, all of them were text-based. The game ran on AOL from 1991

to 1997 – coincidentally, the year Garriott released his groundbreaking foray into Web RPGs, *Ultima Online*.

Sadly, even *NWN*'s relative success wasn't enough to save the Gold Box empire from collapsing. By the time SSI's attempt at digitising the *Dark Sun* setting, *Dark Sun: Shattered Lands*, was released in 1993, interest in the property had faded, and the game itself – unfinished and bug-ridden – earned SSI its first real dose of negative press. Billings remembers how it all happened: 'We had a seven-year license; it went from '86 to '93. And from about '92 onwards, with the *Dark Sun* fiasco, we were looking to sell the company, because the investments to make the game were getting too large. It was way beyond what we could do, and we were looking to sell. We had a deal with EA in '92 that fell through at the last moment, and I think that was probably because they'd just bought Origin.

'At this time, TSR was getting really difficult to deal with, to be honest. It wasn't clear what they wanted going forward; we were paying them a lot of royalties as the years went on, and yet they were looking for ways to get even more out of it. And they ended up in a situation where they let the rights with us go away, with no real encouragement for us to do any more work with them, what with the way they were acting. That was a mistake – there was nobody like SSI back then; just a bunch of guys in the development department who loved RPGs and wanted to do D&D games. I think TSR just wasted the opportunity with us by basically thinking they could get more, and trying to keep their options open. At one point, they were even thinking about trying to do it themselves, but they gave up on that. So D&D was doing great with the Gold Box games, but then it just stopped. *Dark Sun* was a disappointment, so we didn't have a clear reputation going forward.'

The end of the Gold Box series didn't just signal the death of a powerful game franchise; it brought a black cloud over the D&D property that wouldn't subside until Interplay, the *Wasteland* gurus, plucked the license in the late-nineties.

An ultimatum

Ultima wasn't doing too well, either. Origin's deal with EA had initially proved fruitful – *Ultima VII*, its expansion, *Ultima Underworld* (1992), and its sequel (1993), all performed beautifully – but when the team went into production with *Ultima VIII: Pagan* (1994), it became clear to Garriott that the two company philosophies didn't exactly mesh. EA's love of one-year development cycles 'Worked very well with their sports games,' according to Lord British, but not with games as complex as the *Ultima* series. The result? *Pagan* was buggy, had many plot sequences and areas hacked off, leaving unfinished quests and story

Below: *Vampire: Bloodlines* combined guns, magic and undead all in the one game.





Below: Over time, D&D-based CRPGs evolved into their own entity, separate from the Gary Gygax franchise.

arcs throughout the game, and sported a much less refined and consistent storyline.

Although Ultima's reputation had been tarnished somewhat by Pagan's shortcomings, there were a group of fans in Rockville, Maryland, who remained faithful. Taking Garriott's 'moral test' mechanics and general world flavour, and stirring lightly with Might and Magic's non-linearity, Bethesda Softworks created *The Elder Scrolls: Arena* (1994), the first installment in one of the most successful modern RPG franchises still breathing. Adopting an attitude of 'freedom before story', *Arena* allowed players to explore an astonishingly large world – infinite in size, actually – and venture into literally countless dungeons and towns; the goal was to give the player everything he could possibly want in an RPG, and then let him create his own story in place of the game's (as put by *Arena*'s creator, Julian LeFay) 'vanilla' storyline.

Todd Howard, executive producer for the last two *Elder Scrolls* games (*Morrowind* and *Oblivion*), considers the primary appeal of the series: 'I think it's the whole idea of creating your own persona, and then doing whatever you want in a big open world. It's both parts together. We've always wanted to create the ultimate fantasy world simulator. We want to, for as many moments as we can, give you a sense of wonder – that you really are this other person in this other world.'

The sense of wonder was increased in 1996 with the release of *The Elder Scrolls: Daggerfall*, which featured a more gripping storyline, gorgeous visuals, and a much less repetitive gameworld. Meanwhile, miffed by Pagan's commercial and critical failure, Garriott decided to change Origin's course and take the Bethesda message to a much more literal level. He wanted to put you in his world – not as the anonymous spectator who exerts limited control over a specific character in a game, but as you and your friends would follow suit. In doing so, the man who'd already

revolutionised gaming gave life to what is now one of the game industry's most lucrative genres: The MMORPG.

There is more than a little bit of satisfaction in Garriott's voice when he remembers how *Ultima Online* (1997) struggled into being: 'Well, by no means was *Ultima Online* the first online game; before it, the most popular online games were on the AOL BBS system.'

'People would dial up to AOL, and they had some multiplayer games that could hold a thousand people. And so we were already talking about how *Ultima* would be a great game to do in multiplayer for quite a few years. We just had this innate belief that, "If you build it, they will come." This was right as the Internet was becoming popular and right after we'd been sold to EA. And the way EA develops budgets for products is that if you have an idea, you first take it to the sales department, and they do a sales projection, and depending on that projection, they determine what kind of budget you might have for your game.'

'Sadly, the biggest-selling online game in history prior to UO had only 15,000 subscribers. And when you do sales projections based on 15,000 sales, you basically have no budget. So EA, for a while, just said "No". But we kept pestering them for about three years, and we continued to press why we thought it would be successful. We finally got a grant of about \$250,000 to do a little experimental prototype. Taking the graphics engine from *Ultima VI*, I think, and the code and art from the previous *Ultimas*, we put a little prototype together.'

'We went on the Web and said, "Hey, anyone who wants to playtest this game with us, please send five dollars for the privilege of being a beta tester, so we can afford to send you a disc." 50,000 people signed up. And that was already, with no advertising, so radically in excess of the lifetime sales EA had expected that UO immediately went from being the bastard stepchild that no one believed in to the most important game in the EA world. After that, the purse strings opened up.'

UO went on to become a massive success, inspiring hordes of developers to try their own spins on the MMO formula – *EverQuest* (1999), *Asheron's Call* (1999), *EVE Online* (2003), *City of Heroes* (2004), *World of Warcraft* (2004) – and also remains an active and popular game to this day. Garriott had conquered the online world; what about the offline one?

His much-maligned return to single-playerdom with *Ultima IX: Ascension* wouldn't arrive until 1999, and although Bethesda had been busily trumpeting freeform RPG design throughout the pre-millennial decade, gamers' hunger for strong, story-based RPGs in the *Ultima* vein was left woefully unsatisfied. Luckily, just as the future was looking exclusively online with UO's release in '97, a true classic arrived to prove that assumption wrong: *Fallout*.

Somehow sensing that there was more to the ideas and mechanics in *Wasteland* than met the 1986 gamer's eye, Interplay developed a new post-apocalyptic property, marinated it in some truly devilish humour, a compelling (and large!) world, tight dialogue and a wonderfully-realised turn-based combat system.

The result? One of the best games of the '90s, and an RPG that still has a frighteningly – yes, frighteningly – passionate following. But that wasn't all the Californian company had to offer – a year later, after acquiring the rather stale D&D license, Interplay released BioWare's *Baldur's Gate*, a deep and elegantly scripted D&D RPG; essentially, it was a Gold Box with a contemporary finish.

EA develops games by asking you to take your idea to the sales department first...

Tormented

Perhaps the most interesting Interplay RPG of all, though, came out in 1999. Its name? Planescape: Torment. Using TSR's relatively new Planescape setting, Torment cast you as a true immortal: The Nameless One. You couldn't die; your corpse would be transferred to safe location by your party, and this could occasionally be used to solve puzzles or traverse impossible obstacles. It was a genius idea, among many others – refreshingly unconventional characters, one of the greatest (and darkest) storylines to grace video gaming and, most importantly, a strong philosophical focus. Torment dealt with issues ranging from chastity to personal growth and redemption. It was, in many ways, Ultima for the Nine Inch Nails generation.

Chris Avellone, lead designer on Torment and co-founder of Obsidian Entertainment, considers the game's primary appeal: 'I think the first thing was that it felt different. A lot of the stuff that was common to RPGs was presented in a new format, and, really a lot of what went into Torment was borne out of my frustrations with RPGs. For example, I'll be honest – I didn't see the need for death in the game, which is always a touchy subject. Basically, it just bored me; it either made me stop playing or I'd just reload, which was a waste of time. So I turned my frustrations about that into a game mechanic. Anyway, I think that the game really tried to remain thematically consistent, and also, I think some appeal was in the fact that it was completely based around you as a player. Planescape's a very egocentric game; it was all about you. Sure, there's a big, evil adversary, but at the same time, all the events that take place in the game are about finding out what you did in your past lives. That makes it more exciting for the player, I think.'

Since Torment, experimenting with the RPG genre became a sort of vogue. Former Ultima Underworld designer Warren Spector released Deus Ex in 2000, which flawlessly fused the immediacy of the shooter genre with RPG sensibilities. The same year, BioWare developed Baldur's Gate II; it expanded on its prequel's premise and gave gamers a storyline that rivalled Torment's. 2001 saw Interplay escapees Troika Games release Arcanum, whose world and plot could be explored and interacted with as never before. 2002 heralded the release of BioWare's powerhouse, Neverwinter Nights and Bethesda's greatest Elder Scrolls game thus far, Morrowind.

SPECIAL FEATURE



Genre of Strength +1

Fortunately, many of the guys and girls who pioneered the RPG genre are still innovating. Billings has returned to his love for wargames, but Avellone has given us Knights of the Old Republic II and Neverwinter Nights 2. Bethesda recently released The Elder Scrolls 4: Oblivion to near-uniform critical praise, and is currently hard at work on bringing Fallout 3 back to life. As for Garriott? He's seen his ideas turn to gold in the past few years – World of Warcraft's astonishing success is a testament to Garriott's stubbornness when it came to making UO – and now, with the upcoming Tabula Rasa, he's ready to revolutionise the MMO just as he did with single player RPGs.

It's pretty clear that the RPG genre is still as varied and ambiguous as it was back when Garriott and SSI were building their first RPGs. We may never be able to pin down what specific game mechanics define games as RPGs, but one thing's for sure – the genre is frequently the locus of innovation. Todd Howard considers the true, basic appeal of being a RPG designer: 'There is no feature or system that is off-limits. You can pretty much try and do anything in your game and people will understand it. You can't really decide to add "leading armies" or "getting married" into a shooter if you wanted, but it's fair game in an RPG.'

Yes – role-playing games are still alive and kicking.

Above Developers are now moving away from the tried-and-true brands of D&D and Vampire, and experimenting with their own IP.

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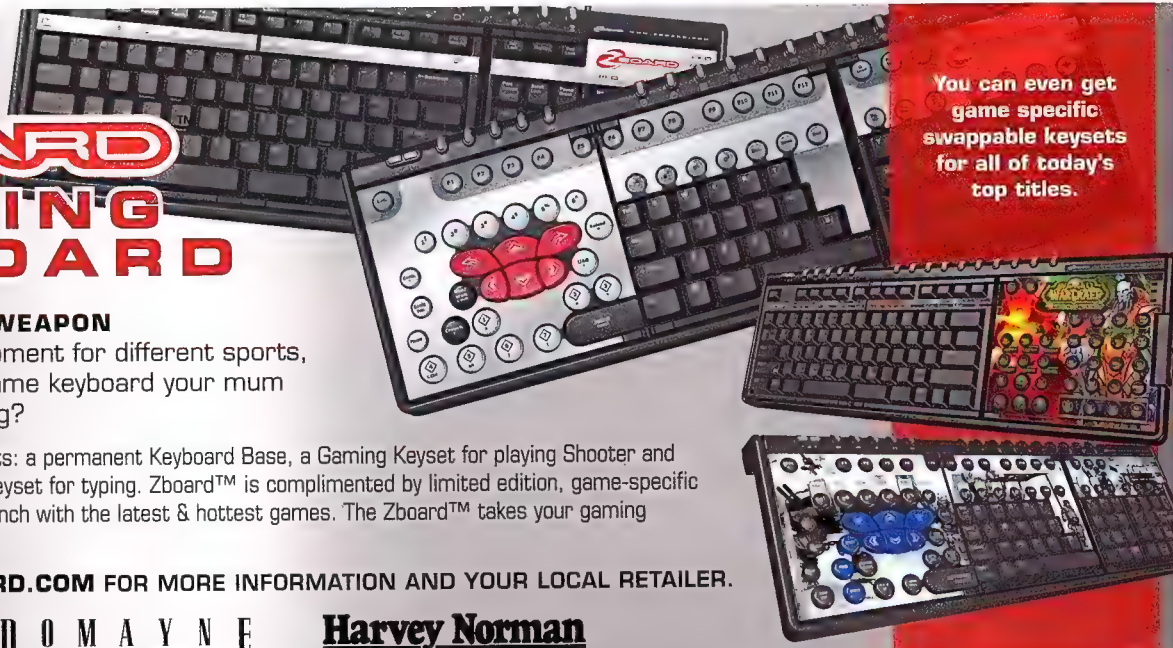
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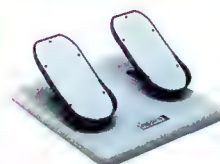


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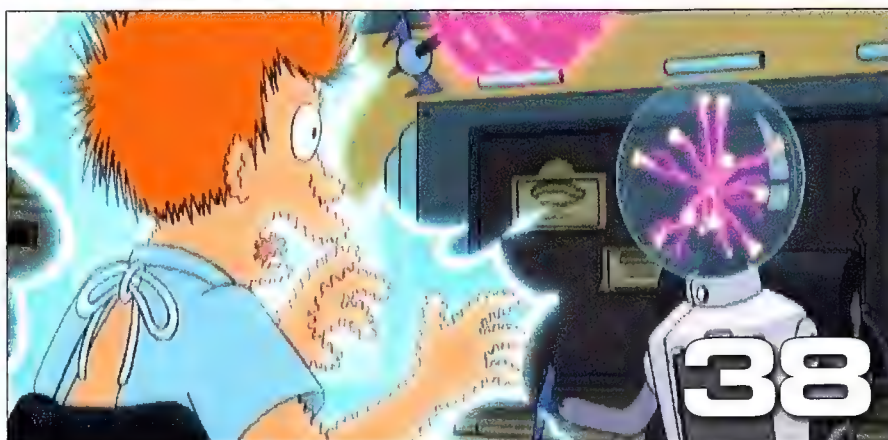
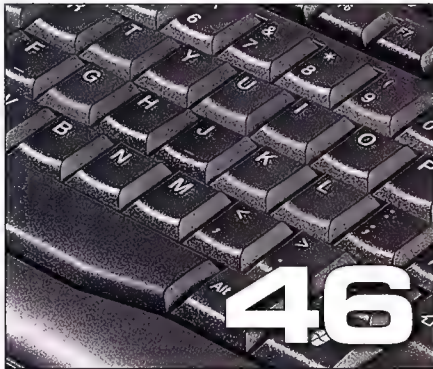
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HARDCORE

NEWS, REVIEWS AND ROUNDUPS ON THE LATEST HARDWARE

What a colourful month this has been – a new graphics card launch for NVIDIA, adding three more products to the 8 series, not to mention its new budget 680i board; an unbelievably massive dual GPU Radeon board from Sapphire; ASUS' shot at a gaming laptop, 690G motherboard and water-

cooled 8800 GTX; and some heavy-hitting RAM from both OCZ and Corsair. In fact it seems that the theme this month has been 'try something new' for all of the companies, with, unfortunately, little success. Still there's always next month, when we'll surely see the R600, right? Right?



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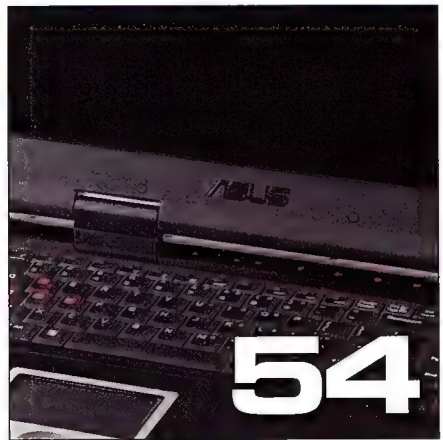
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BENCHMARK

How we test,
what we test,
when we test it

3DMark05 and 06 are the legs of our bench. As freely downloadable tools, they allow people all around the world to compete on a single platform, regardless of its indication of real world application, and its ability to keep our table stable.

On the gaming surface, Call of Duty 2 takes first honours in the FPS department. Quake 4 follows closely behind for our OpenGL benchmarks, taking over from where the venerable Doom 3 left off and offering multiple CPU optimisations. Half-Life 2 remains, its market penetration simply too huge to ignore. X3: Reunion makes an appearance, in an effort to have a benchmark that is not an FPS. In the same line, Splinter Cell: Chaos Theory has also been added. Other games do exist. Honest.

All tests are run at 1280 x 1024, 1600 x 1200 and 1920 x 1200 with vsync off, to cater for the most popular LCD resolution, CRT resolution and those who own widescreen monsters respectively.

To hit the CPU, we use LAME MT, a multithreaded version of the



The Atomic Hot Award is given only to the best. In our roundups, we differentiate the best further using the following awards:

VALUE AWARD This means the product is the best buy price-wise.

PERFORMANCE AWARD Price isn't a big factor – it just has to make our benchmarks burn and our eyes water.

EXTREME AWARD Forget everything. If it's mind-blowingly amazing, then it'll get an Extreme Award.

popular MP3 encoder, which is used to compress a standard 30-minute WAV file. Similarly, VirtualDubMod is used to compress a standard 1GB raw video file into XviD at 1300Kb/s. Other CPU specific tests in our stable are Maxon's CineBench and SuperPi Mod. Rounding out the suite, SiSoftware's Sandra tests several subsystems across the board, while HDTach and ATTO Disk Benchmark helpfully provide hard drive scores.

All these tests are run on a Windows XP SP2 platform, running the latest official drivers available. Every test is run three times to eliminate any oddities that may crop up along the way, the final result printed in the magazine being an average of those scores.

Of course, all this is pointless without a standard set of hardware, and as such it is laid out below for the world to see. On with the testing!

BENCHMARKS

Graphics

3DMark05

Game tests only, 4xAA, 8xAF
www.futuremark.com

3DMark06

Game tests only, 4xAA, 8xAF (SM2.0), 8xAF (HDR/SM3.0)
www.futuremark.com

Half-Life 2

Canals custom timedemo, 4xAA, 8xAF, all details highest, HDR off
www.half-life2.com

Splinter Cell: Chaos Theory

Lighthouse Demo, Shader Model 3.0, 8xAF, shadow resolution high, all features on
www.splintercell3.com

X3 Rolling Demo

High settings, auto quality control disabled, glow enabled, 4xAA, 8xAF
www.egosoft.com/games/x3/info_en.php

Call of Duty 2

Hill 40 – Defend custom timedemo, 4xAA, 8xAF, all options highest
www.callofduty2.com

Quake 4

High quality, 4xAA, 8xAF, Multiple CPU support, all options highest
www.quake4game.com

Subsystems

HDTach

www.simplissoftware.com

LAME MT

softlab.technion.ac.il/project/LAME/html/lame.html

VirtualDubMod

virtualdubmod.sf.net

SuperPi Mod

www.xtremesystems.com/pi

Cinebench

www.cinebench.com

SiSoft Sandra

www.sisoftware.co.uk

Everest

www.lavalys.com

Others

DisplayMate

www.displaymate.com

ATI Tool

www.techpowerup.com/atitool

RivaTuner

www.guru3d.com/rivatuner

FRAPS

www.fraps.com

CPU-Z

www.cpuid.com

Stress Prime 2004 Orthos
sp2004.fre3.com

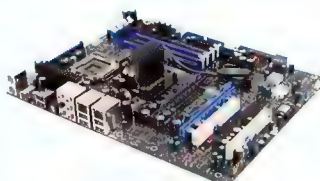
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▲ 2GB OCZ Flex XLC PC2-9200

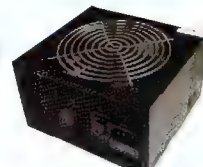
WD

Western Digital



▲ WD 1500ADFD

PC Case Gear



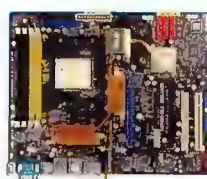
▲ Seasonic S12 600W

AMD



▲ AMD Athlon 64 FX-62

ASUS



▲ ASUS M2N32-SLI Deluxe

OCZ Technology



▲ 2GB OCZ Flex XLC PC2-9200

DELL



▲ Dell 2405FPW

ASUS



▲ ASUS 8800GTX



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975X7AB-8EKRS2H



HARDCORE

CODECS

CLASH OF THE



CODECS

David Field engaged in mortal combat with today's most popular video codecs. Find out which ones he massacred.

Back in the Paleolithic age – just after man had discovered stone tools and how to load CD-ROMs into caddies – stunning pixelated video played back from our mighty 486s. In short, we have video codecs to thank for that and everything that evolved from it.

In the many years since that early time, video quality has increased thanks to ever-expanding storage capacities and processing power – the two building blocks of high quality digital video. At the same time we also developed a taste for better quality from physical media and video, with a bitrate small enough to be streamed over our measly bandwidth limits.

All codecs (a contraction of code/decode), whether they be for video, audio or some other type of data, exist to change a long bit series into a shorter bit series and back again, or at least into something that closely resembles the original. This magic process is called 'compression' (or 'decompression' in the latter case).

It's taken its sweet time, but high definition video is finally here in the form of HD-DVD and Blu-ray. Although they're both a huge jump up from DVDs, there's very little difference between the two formats: They provide 1920 x 1080 (or 1080p) resolution, have considerably more space and higher transfer speeds than DVDs and both use the same codecs to decrease the size of the original video so it can be shoehorned onto the disc.

If you are wondering why optical discs still need to use compression to hold a movie when they can now store anywhere from 15 to 50GB and transfer data at a minimum of 36MB/s, ask this question instead: How much space do you need for *true* high definition video?

MOVIES IN SPACE

Here's a fun and jaw-dropping fact about digital video: At a post-production house, an uncompressed two-hour film in digital cinema resolution and quality will clock in at about 12 terabytes, less 9 to 18 gigabytes for the accompanying 16 channels of 48 or 92kHz audio.

Some of this can be explained away when you consider digital cinema's 4096 x 2160 (or 4K) resolution, but the data rate is still monstrous – far too high for commercial cinemas to read and project, let alone store. This is why digital films are perfectly – or 'losslessly' – compressed to no more than 500GB, resulting in visually identical footage that requires a bit of decoding processor muscle.

Even after you account for the drop in resolution from 4K to 1080p, it's still clear that no consumer format has enough space to deliver this kind of perfectly reproduced image quality. And that's just the film – we haven't even thought about the space needed for the extra features we've come to expect from our discs yet. This is where 'lossy' codecs come into play. They're much more complex than lossless codecs, and we'll examine them after we've looked at the basics of compression.

SLICE AND DICE

Compression in general exploits patterns that exist in data sequences. If lengthy patterns can be replaced with a more concise placeholder, the sequence will become smaller without any information being lost.

If you're thinking of ZIP and RAR files right now, you're on the right track. Conceptually,



IN PRACTICE, ALL THEY DO IS THROW AWAY INFORMATION FROM THE PICTURE THAT IS HARD FOR YOUR EYES TO PERCEIVE, AND EASY FOR YOUR BRAIN TO MISS.

lossless video codecs resemble a RAR archiver designed for video. There's a hard limit on how much data you can remove, which is governed by the laws of information entropy. To sidestep these hard mathematical limits, we have to be prepared to sacrifice some data first.

Lossy codecs not only use straight compression, they exploit the way we perceive video and the way it is constructed. They predict what will happen from one frame to the next, then deliberately leave data out, then take a mathematical guess at what to fill in the blank spaces with later on. It sounds scary, but in practice all they do is throw away information from the picture that is hard for your eyes to perceive and easy for your brain to miss.

WHAT'S IN A FRAME?

At the most basic level, a video is just a series of images (in this case, frames) displayed one after the other at a constant rate. The rate determines the look and smoothness of the video; 24fps for a movie, 25fps for PAL and 29.97fps for NTSC.

Like a bitmap, every frame of video is made up of a grid of pixels arranged along the X and Y axes. Think of a video as thousands of frames positioned sequentially down the Z axis that are displayed one at a time, every 1/24, 1/25 or 1/30 of a second. Video sequences differ slightly from computer images as the pixels aren't made up of RGB values – they are stored in a YCrCb colour space. This meshes a full resolution greyscale (luma, or Y) layer with two layers of colour (chroma, or the red component Cr and the blue component Cb).

Generally, video contains a full resolution luma image and half resolution chroma images, which are scaled up and layered over the full resolution luma image. This effectively colours in four pixels of a detailed greyscale image with one pixel of colour. The technique is called chroma subsampling, and it works because our eyes are much more sensitive to the brightness of a signal than its colour. This little biological quirk not only came in handy when colour was added to the first black and white TV signals, but it's also used to reduce the bandwidth of a video stream.

All MPEG formats use 4:2:0 chroma subsampling to halve

the video bandwidth of a high quality master source. Not only is it very hard to tell the difference between a half bandwidth 4:2:0 signal and a full bandwidth 4:4:4 signal, material encoded with any MPEG codec (which encompasses most of what we watch) is subsampled at 4:2:0. You literally won't know what you're missing unless you see a film shot and projected digitally with fearsome gear like the Arri D20 and Sony's Cinealta projector.

And yes, we're purposely sweeping the whole 35mm film thing under the rug.

DID WE SAY MPEG? WE MEANT MATHS

The Motion Picture Experts Group, or MPEG, is easily the biggest player in the lossy video codec game. It's been around for the last 18 years, has a lot of imitators and a legacy of codecs used in all facets of the industry. MPEG-1 drove VCDs. MPEG-2 drove DVDs. If it hasn't already, MP3 should win the award for the most publicly recognisable IT acronym in the world.

The MPEG-4 specification is more of a container standard than a codec. It's comprised of 23 parts, not all of which are dedicated to video. Part 2 is the standard video codec – the same compression scheme that both DivX and XviD are based on. Part 10 is a more advanced video codec – known formally as H.264/MPEG-4 AVC. H.264 is one of the three codecs that drives both HD-DVD and Blu-ray.

Aside from throwing away half the colour information from a high quality master to save space, codecs (MPEG-based and others) use other techniques to approximate data from a video file before compressing it. Here are the most common techniques:

SPATIAL COMPRESSION

Using a technique similar to that of JPEG to compress still images, the size of a single image can be reduced. This does reduce the image size, but not greatly, mostly relegating spatial compression to the domain of lossless codecs. It still serves a fairly major purpose in the process of lossy encoding though, as you're about to find out.

MEET THE CODECS

NEW SCHOOL

x264

Reverse-engineering industry standards is a great open source tradition, and x264 is the result of the video industry's new wonder codec, H.264, being given the treatment. H.264 is a joint venture between the video arm of the telecommunications standardisation sector (think video-conferencing) and the Moving Picture Experts Group, and it's encapsulated in the behemoth that is the MPEG-4 standard. It's very different to and much more processor intensive than standard MPEG-4, which is why it's used with HD-DVD and Blu-ray, some hard drive-based HD cameras and, perhaps most importantly, broadcasting.

Like H.264, x264's strength lies in the way it

treats macroblocks. It can work with standard 8 x 8 pixel macroblocks as well as 4 x 4 blocks and rectangular macroblocks if a frame is detailed enough to warrant it. It also supports cut detection for better I-frame placement and motion compensation. If you're game, you can even toy with custom quantisation matrices. x264's roots may be deeply entrenched in H.264's heart, but its slight differences make it unsuitable for broadcast. We included it in our test because it's better suited to PC-based archival and we already have a broadcast codec in the roundup.

WMV9

We couldn't let Windows Media 9 slip underneath the radar for a few reasons. Its SMPTE-approved identical twin VC-1 is driving the images on HD-DVD and Blu-ray,

and it uses the same fundamental coding mathematics (DCT) as MPEG without, er, 'borrowing' MPEG theory. One such technique involves using what are known as zig-zag tables to reorder the data into one of 13 preset patterns. One of these patterns will yield better compression.

WMV and VC-1 aren't as demanding as x264 and H.264, but in comparison to the other codecs available, they're both highly asymmetrical – they take a lot more time to encode something than decode it. They also need a lot of processing power to draw a series of frames based on the encoded data. This is why, when H.264 found its way onto the iPod in an effort to reduce the video file size but maintain the quality level, a dedicated decoder chip found its way into the circuitry to tackle the encoding.

TEMPORAL COMPRESSION

Apart from some epilepsy-inducing Japanese music clips, all video is continuous. From one frame to the next, most of the detail stays the same: Think of the background, the walls or, if he's been cast, Keanu Reeves' expression. Why waste precious storage space to store tens of thousands of images of Keanu Reeves if he looks exactly the same in 90 percent of them?

This is exactly what temporal compression does. A keyframe (known in the MPEG world as an I-frame) that contains all the important data is drawn, and in the following frames whatever doesn't change is left out and filled in with data from the keyframe. Temporal compression literally means compression in time (as opposed to spatial compression, which is literally compression in space) and it can slice away massive amounts of data.

Keyframes are reference points in a movie made of a spatially compressed image that is used by subsequent frames to fill in parts of the image that stay the same from frame to frame, letting them be replicated instead of repeatedly encoded. As such, the best position for a keyframe in a sequence is when the sequence suddenly changes, such as a cut between a dim indoor game of cards and an outdoor shot of a car about to run into the house where said game is being played.

MOTION COMPENSATION

Temporal compression has some limits, in that it doesn't deal with camera pans very well. When an object moves from one location in a frame to another, the scene has to be updated even if the element itself doesn't change. MPEG-4 introduced motion compensation, which uses vectors to push static elements around a frame in time instead of redrawing them.

Motion compensation and temporal compression are the keys to reducing data, and the reason why when you jump to a point in a video on an old machine it takes a second to play. The codec has to render the keyframe first then recreate all the frames between it, as well as the frame you requested.

DISCRETE COSINE TRANSFORMATION

Although you'll need a degree in computer science to fully understand it, the DCT is the heart of a lossy encoder. In short, it's a process of approximating numbers with a degree of accuracy. During an encode, every number in a series is simply halved and the remainders thrown away. When it comes time to decode, they are doubled, resulting in values that closely resemble the original.

The technique works better on bright areas than dark ones, which is why compressed blacks don't always look as smooth as their non-compressed counterparts, although codecs can control this.

MACROBLOCKS

It's inefficient, especially when video is stored in a YCrCb colour space, to refer to each pixel individually. Macroblocks are groups of (usually) 8 x 8 pixels that have their values converted to a formula. Because neighbouring pixels normally look very similar, the formula determines the average brightness of the pixels and how they change relative to the average value of the macroblock.

QUANTISATION MATRIX

Here's another tricky concept deeply rooted in hardcore mathematics. Think of a quantisation matrix as a palette of values that controls how the pixels in a macroblock are converted from pixels to a formula. Modifying it modifies the way pixel information is thrown away.

MULTIPASS ENCODING & VARIABLE BITRATES

Thanks to the world of audio codecs, you should already be familiar with the concept of variable bitrates. In short, they let you open the bandwidth taps during the more visually intensive scenes and use less bandwidth for the more placid scenes.

Multipass encoding is an extension of this; it lets the codec plot where to position keyframes and how to allocate its bandwidth resources as the footage progresses.



**FROM FRAME
TO FRAME,
MOST OF THE
DETAIL STAYS
THE SAME:
THINK OF THE
BACKGROUND,
THE WALLS
OR, IF HE'S
BEEN CAST,
KEANU REEVES'
EXPRESSION.**

OLD SCHOOL

DIVX

Originally created from the ashes of an early build of a Microsoft MPEG-4 based codec, DivX has evolved into a container format and has developed a reasonably friendly user interface. It's maintained in-house by DivX Networks, a company that earns a multi-million dollar crust by licensing out its codec for use in DVD players and providing a high quality alternative to YouTube.

XVID

Before DivX went commercial, it launched Project Mayo, an open(ish) source multimedia project. It was eventually scrapped, at which point some of the contributors to Project Mayo took their work and retooled it into XviD. It too

is based on MPEG-4.

XviD uses global motion compensation to handle camera tilts and pans as well as quarter-pixel block motion compensation for movement of fine detail. It works best on two-pass encoding and is quite refined thanks to its popularity with users and project contributors.

REALLY OLD SCHOOL

CINEPAK

The geriatric of the bunch, Cinepak arrived on the scene in 1992, just after the dawn of QuickTime. Cinepak was the first non-Apple codec ever added to Apple's multimedia framework, and in 1993 went on to be the first non-Microsoft codec to be added to Video for Windows – which predated DirectX and DirectShow. It was also responsible for FMV in early games, both on PCs

and consoles like the Sega Saturn.

Unlike most DCT-based codecs, Cinepak uses the simpler vector quantisation combined with motion keyframes to reproduce blocky images, albeit with processor requirements from the early '90s. It works by dividing the image into sections and assigning each its own 256-colour palette. These sections are then subdivided into blocks of 4 x 4 pixels, which instead of being assigned colours are given references to a section's colour palette and told how to assign colour to the pixels in the block.

Originally, it provided 320 x 240 video at bitrates within the reach of x1 CD-ROM drives, but has been improved since then. Although we've included it in our tests for reference, you're crazy if you use it for anything serious.

It's been well and truly eclipsed.

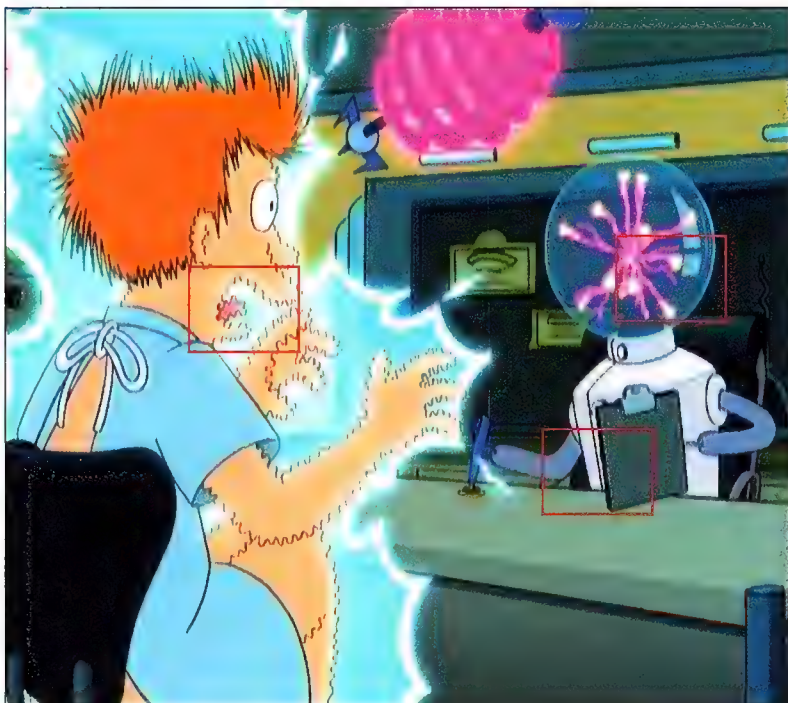
TO THE LABS!

We picked a few choice DVDs from our collection that we felt would provide the codecs with a good spectrum of different material to work with. We cropped out 40 frames, exported them as an uncompressed RGB sequence, then exported this with VirtualDub Mod into different codecs with different settings. And we did this over and over and over again. We used the default codec settings, but

tweaked any choices between quality and render time to maximum quality, as well as setting all the codecs to two-pass variable bitrate with a specified target.

We wound up with three sequences encoded in 300, 700, 1500 and 3000Kb/s in five different codecs. DivX and XviD were chosen because the similarities in their lineage allow us to see the work of the open source movement pitted

RESULTS



FUTURAMA

Most animation is quite simple. To cut down on the time it takes to draw an animation, movement generally changes every two frames. They contain large expanses of solid colour and constant backgrounds, but can also contain sections of complex CGI, like the doctor's head in this example.

XviD handled backgrounds very well, but had a problem with edge definition at lower bitrates. It overcame these problems at 1500Kb/s, but struggled with gradients until 3000Kb/s, where it looked mostly flawless.

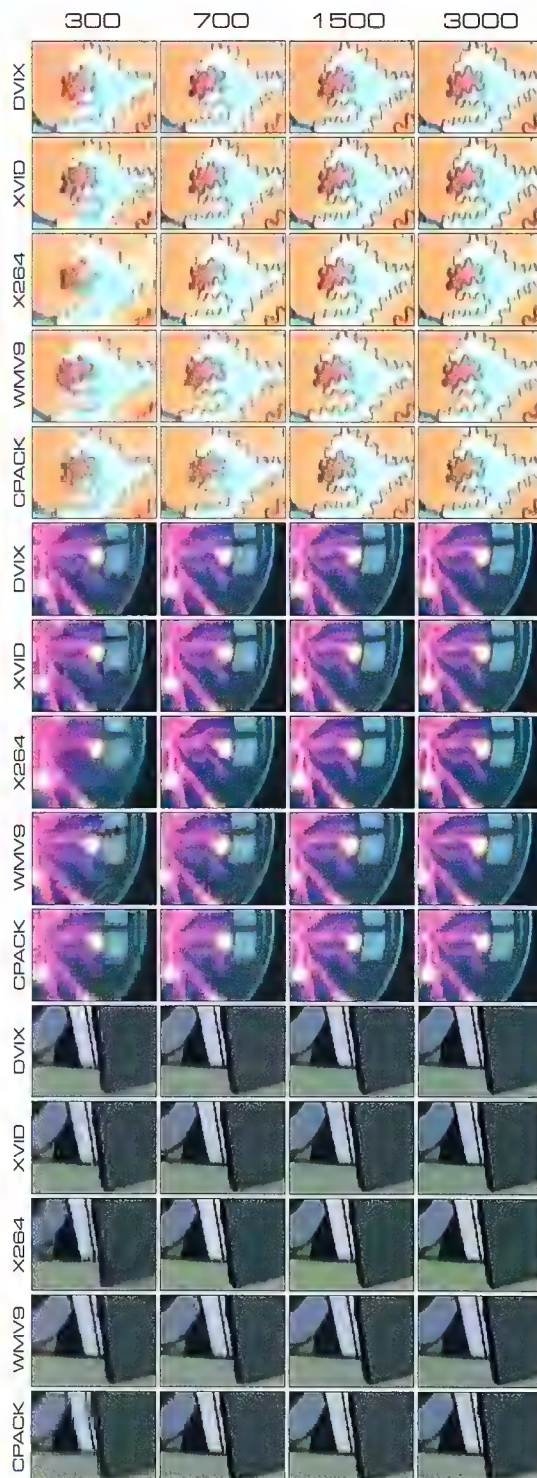
DivX was blockier than we were expecting when it was faced with high motion and low bitrates, but settled down quickly when given real world bandwidth to play with.

x264 produced total rubbish at 300Kb/s, but the jump in quality it produced when given 700Kb/s was astounding. Its variable macroblock size handled edges and the crazy outline around Fry better than any of the other codecs. Strangely, at high bandwidth, lines seemed soft and almost blurry – but this was masked purely by the colours and style of the animation.

It may not look like it from the stills, but WMV performed incredibly well at low bitrates, reproducing gradients at the cost of line definition.

The blockiness that we had come to expect at low bitrates wasn't as pronounced as the other codecs, and like x264, it too produced a soft encode.

XVID HANDLED BACKGROUND DETAIL VERY WELL, BUT HAD A PROBLEM WITH EDGE DEFINITION AT LOWER BITRATES.



against proprietary software. Windows Media 9 (WMV9) is almost exactly the same as VC-1 – Microsoft's HD-DVD/Blu-ray codec – only with more options. It's not based on an MPEG standard either; so in it went. x264 (H.264's open source equivalent) was thrown into the mix too, as it represents the new wave of computer-based open source codecs. Cinepak was added just for laughs and to see what

a difference 15 years makes in codec land.

We dropped every encoded sequence back into VirtualDub and picked one frame that we felt demonstrated the encoder's prowess, checked that none of the sequences used that particular frame as a keyframe and then exported the frame as an image. After all, we wanted to see what the encoders were doing, not what they were relying on.

RESULTS



▲ FIREFLY

Many codecs don't do dark footage justice because of the way they approximate colour values. You can see this in low bitrate YouTube videos that have large black gradients that have clumped together. We also needed something to test close-ups to see how the codecs dealt with detail in a human face, and a bit of fire (on screen, anyway) never hurt anybody.

XviD crunched a lot of the details in the blacks out, especially at low bitrates. At 700Kb/s, ugly gradient smearing was still visible when all the other codecs had dealt with it. Skin detail was still pixelated at 3000Kb/s, but the rest of the image (especially outlines) looked great.

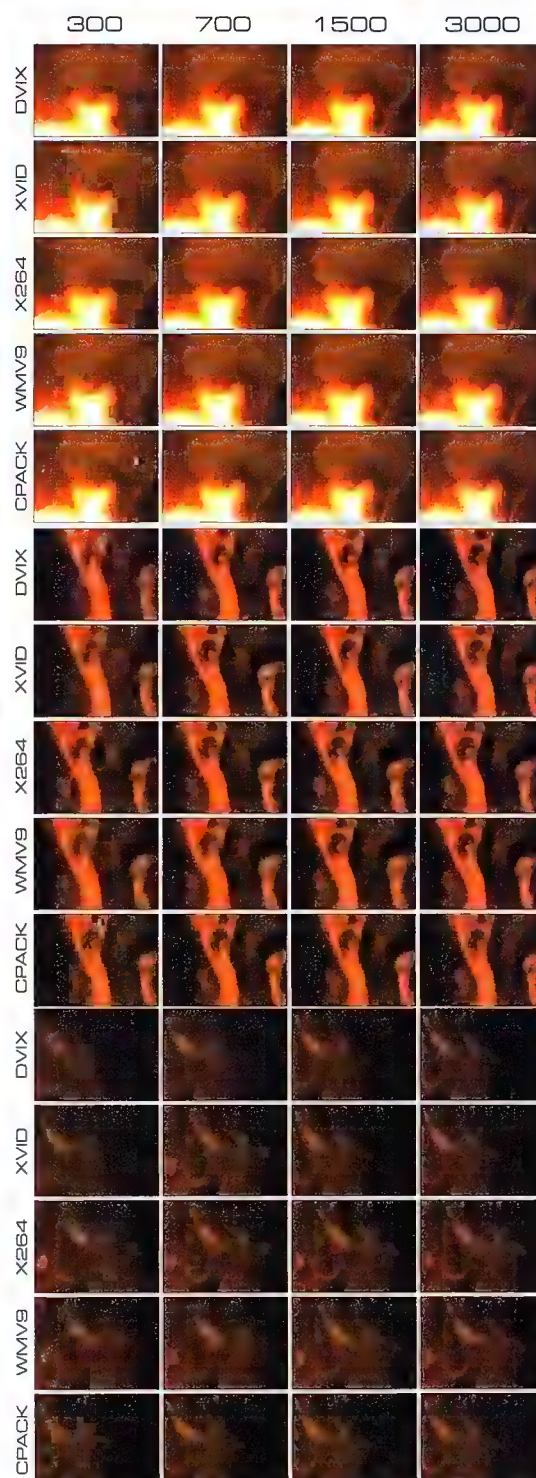
DivX fared better than XviD overall, showing less blockiness and better gradients, but still lacked the skin detail that we'd come to expect from it. From experience, this is less of a problem in brighter scenes.

x264 didn't fare too well at low bitrates, but stepping up to 700Kb/s corrected most

of its problems except for detailed skin gradients and low lighting; although it did render the torch nicely. At 3000Kb/s, all is forgiven – it looks the closest to the original.

WMV hid its low bitrate compression artefacts under softness. The reflections of the fire from the side of the doctor's face look too static at low bitrates, but this gets better as we ramp up the bitrate. Not as good as x264, but better than XviD/DivX.

Ultra fine detail, such as the curly hairs on the man's head (we've dubbed him Patoli) show the fundamental ways in which codecs deal with information. DivX smooths out the grain of the film, then blocks information together. XviD keeps the grain, but the macroblocks become speckled, which lowers the detail. x264 tries to approximate how the data clumps together and does a reasonably good job of injecting information back into these areas. WMV uses gradients to give the illusion of depth. And Cinepak, as expected, remains a speckled mess.



RESULTS



TROY

This scene is a real killer. At low bitrates, the people walking around on the sand turned into sprites drifting across the frame. A lot of the poor results have to do with the source – an MPEG-2 stream from a DVD that does produce fine details, but struggles to do it well.

DivX was awful at low bitrates, only showing fluid movement in the sails of the ship. At 700Kb/s only a bit of finely detailed movement was visible, but it only became remotely watchable at 1500Kb/s. It had its act together at 3000Kb/s but we still saw blocky edges around small details.

Although XviD smeared less than DivX at low bitrates and did contain some fine movement, it still lacked too much detail for our liking.

Only under x264 did the people seem to be moving. For a laugh, we encoded it at

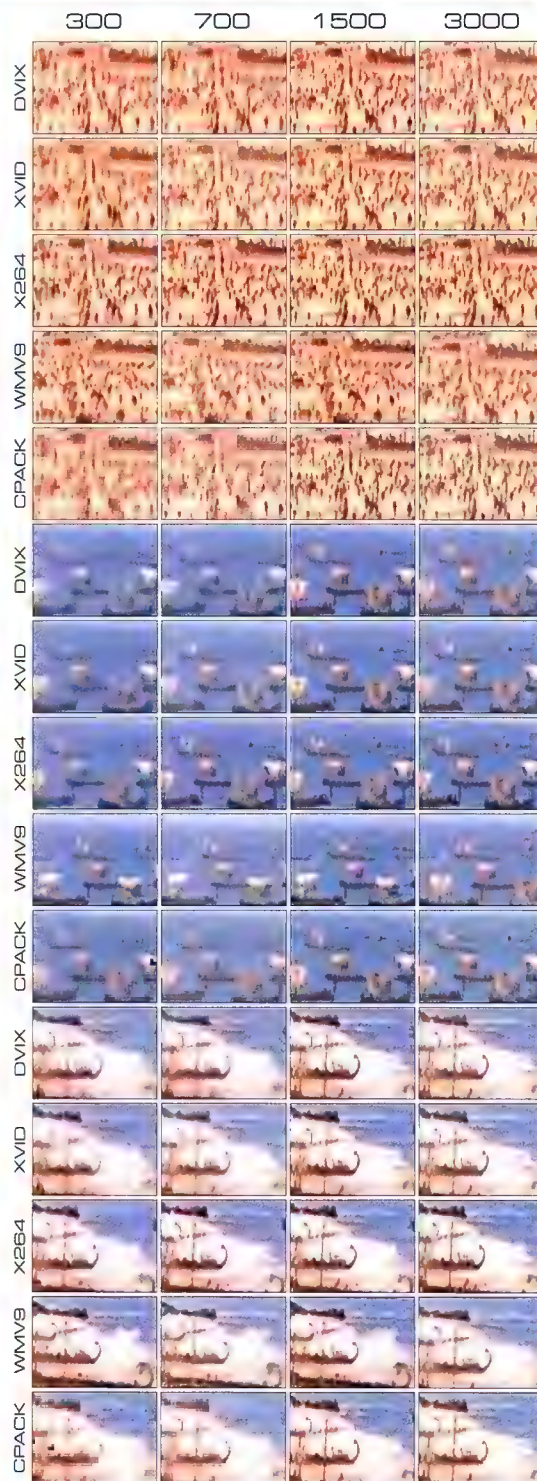
150Kb/s with x264 and still saw movement, but sections of the frame (most of which were in the distance) were completely blurred out. At high bitrates, it won out, but only just.

WMV didn't provide the kind of detail in low bitrates as x264, but at the top end details in the shore that x264 had blurred out were visible.

It didn't render movement in the distance as well as X.264, but did an admirable job.

Examine the frames closely and you can see that at low bitrates, all the codecs (bar Cinepak) have simply blurred out the ships in the distance.

This is the best visual representation of what codecs do. In the words of Tyler Durden, they have the ability to let that which does not matter truly slide.



DIVX WAS AWFUL AT LOW BITRATES, ONLY SHOWING FLUID MOVEMENT IN THE SAILS OF THE SHIP.

CONCLUSION

We've covered a lot here but video technology is both a science and a black art beyond the scope of this Head to head – and one best approached with a degree in computer science. If you're simply looking for a definitive answer as to what the best quality encoder is, you won't find it here – or anywhere else for that matter. There is a chasm of optimisations you can specify during the encoding process that can vary the results dramatically, which is why we left all the options at their defaults.

Codecs work differently with the mathematics behind a certain visual style, and visual styles are as varied as the rows of tapes in the BBC's archive are long. On top of this, the best encodes use the vast array of options available in a codec to fine tune its encoding mechanics and put it in harmony with the style of the source material.

So what you've read here is a primer, and what you've seen a guideline. If you see a characteristic you like from our tests, investigate. Run your own tests with the footage you normally work with. Become one with the options.

That is the way of the codec.

Vista SideShow Now Available on Motherboards

ASUS ScreenDUO Exclusively Supports Vista SideShow for a Complete Vista Experience

ASUS is the first motherboard manufacturer to attain the Microsoft Windows Vista Premium logo as well as the one who enriches Windows Vista the most. Windows SideShow is now no longer exclusive to notebooks as ASUS introduces the world's first motherboard with Windows SideShow support. With the innovative use of ScreenDUO, users will be able to enjoy the convenience and benefit of displaying critical PC info and syncing with the PC for email and RSS feeds.

Feature-Packed Motherboards

ASUS Vista Edition motherboard models that are designed especially for the new operating system are all packed with ASUS special features like ScreenDUO, AI Remote, AP Trigger, ASAP (ASUS Accelerated Propeller) and TPM support (Trusted Platform Module). I recently had the chance to test out these ASUS motherboards to experience what they offered in terms of Microsoft Windows Vista™ technologies.

Versatility with ScreenDUO

The innovative ScreenDUO helps provide the user with a secondary display panel - which can conveniently display important information without having to start up the PC. Often accessed functions like RSS newsfeeds, meeting schedules and synchronised information from the PC or websites can be viewed on this handy screen to save time.



Convenience at your fingertips with AI Remote

I was pleasantly surprised at the sheer amount of things I could do from the couch! Besides being able to play my favorite media files, the simple yet complete design of the AI Remote allowed me to switch the PC on/off, launch my favorite applications with the AP Trigger function, and gave me total control over AI Gear and AI Nap. These features were added on top of what I would have expected from a traditional remote for a media player.



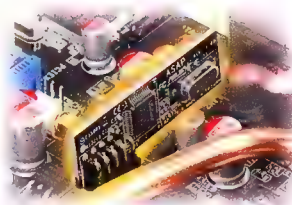
Speedy Launches with AP Trigger

Ever wanted to start up the PC to just play a certain music file or resume working on something you were doing just a few hours before? With the ASUS AP Trigger, you can. Quickly boot or resume media and favorite pre-defined applications with just a touch of a button from this handy function.



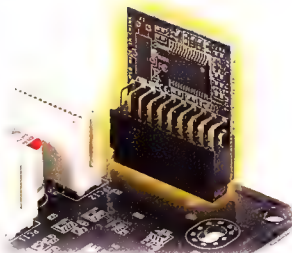
Accelerated Performance with ASAP (ASUS Accelerated Propeller)

With ASUS's ASAP technology, I was able to get things done faster. ASAP supports the Windows ReadyBoost™ technology - improving system performance while running under Microsoft Windows Vista™.



Protected Data with TPM support

Another useful feature that I found with these motherboards was the Trusted Platform Module (TPM) - which provided enhanced data protection, security via high-level encryptions / decryptions and platform integrity. This TPM module allows the ASUS motherboards to attain the Windows Vista BitLocker™ Drive Encryption hardware requirement - giving me a far more secure working environment. Note: The TPM module is purchased separately.



Available Models

Model	M2N2-SLI Premium Vista Edition	M2N-Plus Vista Edition	P5B Premium Vista Edition	P5B-Plus Vista Edition
CPU	AMD Athlon 64 FX	AMD Athlon 64 FX	Intel® Core™2 Quad	Intel® Core™2 Quad
Chipset	NVIDIA nForce 680 SLI/MCP	NVIDIA nForce 680 SLI/MCP	Intel® P965/ICH8	Intel® P965/ICH8
ASUS AI Lifestyle	*ScreenDUO *AI Remote *AP Trigger *TPM (optional)	*AI Remote *AP Trigger *TPM (optional) *ASAP	*ScreenDUO *AI Remote *AP Trigger *TPM (optional) *ASAP	*AI Remote *AP Trigger *TPM (optional) *ASAP
Features	*ASAP	*ASAP	*ASAP	*ASAP

Xbox 360 Connectivity Kit ▶

Price \$25 Supplier CoolPC Website www.coolpc.com.au

What's that? You have no idea what the heck this collection of assorted bits does, even after staring at the image for a good 30 minutes? Don't panic, it's actually not that complicated. If you're looking to flash the firmware on your Xbox 360's optical drive, but don't fancy the idea of taking the drive out of the console, then say 'Hello' to your saviour. There's even a debug mode that allows the drive to be recognised in standard operating systems. Now, why would you want to flash the ODD of your 360? We'll give you one guess, and one guess only...

▼ Icemat Glass Mousepad 2nd.Edition

Price \$69 Supplier GamerzStuff Website www.gamerzstuff.com.au

What's rough, cold and smells like cheese? If you said 'Grandpa' you'd be right, however, if you also said 'The Icemat Glass Mousepad 2nd.Edition' you'd also be right! Although it looks really neat, sitting on your desk all black and glass-like, this mousepad sounds like a chunk of sandpaper on wood when you drag your mouse across it, and the precision seems a bit funny as well.

Xbox 360 Chrome Controller Shell ▶

Price \$49 Supplier CoolPC Website www.coolpc.com.au

If for some insane reason the uh, bold white of the standard Xbox 360 controller chassis fails to do it for you, you can replace it with this fancy chrome shell. Functionally, your gamepad will be the same, but its abilities as a fingerprint magnet, low-tech blinding device and futuristic-looking thingamajig will skyrocket. It's not at all hard to get on to your controller, but if you have any doubts at all, we recommend you grab a friend. But since when has an Atomican been afraid of cracking open hardware like a walnut?



◀ Talisman Window Cutting Tool

Price \$29 Supplier CoolPC
Website www.coolpc.com.au

Chances are if you own an Xbox 360, and nothing but an Xbox 360, actual case modding – like cutting plastic, steel or fingers – resides in that special place along with your high school education and the respect of your peers. If this sounds like you (and Gandalf be with you if it does), then the Talisman Window Cutting Tool will take the pain and effort out of making your 360 look rad, you big-arse nerd.

Xbox 360 Black Replacement Case ▶

Price \$55 Supplier CoolPC
Website www.coolpc.com.au

Keeping with the decidedly Xbox 360 nature of this month's Gearbox (never fear, we'll get back to the PC next month folks) here's a replacement chassis for Microsoft's next-generation console. Again, if the idea of popping the case off of your expensive hardware scares the seven hells out of you, then for the love of God, just don't do it. Keep in mind that the only other way to get a black Xbox 360 is to pay for the recently announced Elite... and it ain't cheap.



▲ Talisman Xbox 360 Whisper Fan

Price \$29 Supplier CoolPC
Website www.coolpc.com.au

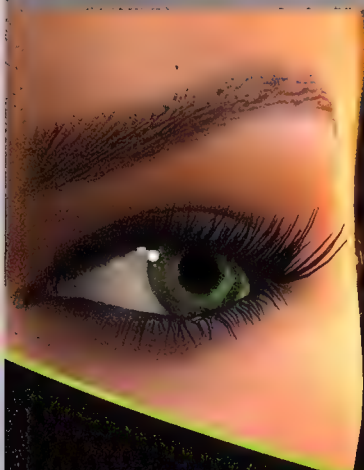
Although marketed as a cooling fan designed specifically for the Xbox 360, we don't see anything stopping you from shoving this sucker into a standard PC or more likely, a compact home theatre box. It will however perfectly replace the stock fan assembly in the 360, moving 17cfm more air for the cost of 500 more rpm. It also apparently does so '7 percent' quieter, if such a thing is even quantifiable.

▼ Everglide t-1000 Professional Gaming Keyboard

Price \$59.95 Supplier GamerzStuff Website www.gamerzstuff.com.au

Arriving a bit late to make it into our mouse and keyboard round-up in *issue 76*, the t-1000 would have made a solid entrant. Featuring a fairly standard 104 keys, the board doesn't have much in the way of extras – just passthroughs for headphones, mic and a single USB 2.0 port, and five function buttons along the top. In use we found the keys were a little cramped and the spacebar, to put it nicely, was rubbish.





Green With Envy
Stop Craving and Start Playing

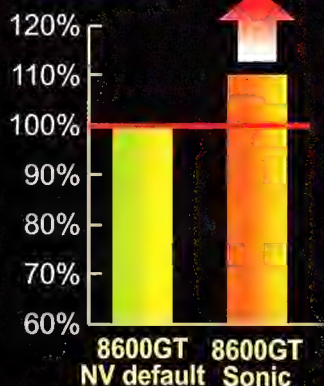
8600GTS

256MB 128bit GDDR3
DirectX10 support
Dual Dual-link DVI support



Sonic
10%

3DMark06



8600GT Sonic

256MB 128bit GDDR3
Memory/Core speed : 1600/600 MHz
DirectX10 support
Dual Dual-link DVI support



8600GT

256MB 128bit GDDR3
DirectX10 support
Dual Dual-link DVI support



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MSI P6N SLI Platinum

Craig Simms wants to know what happened to the bronze, silver and gold editions.

SPECIFICATIONS

Price \$TBD **Street Price** \$264
Supplier MSI
Website www.msi.com.tw
Specifications Socket 775; 650i; 2x PCI-E x8 (dual mode, operates at 16x in single mode); 1x PCI-E x1; 3x PCI; 2x IDE; 4x SATA; 1x eSATA; Realtek ALC888; optical and coax S/PDIF; 1x Gigabit Ethernet; 8x USB; 1x FireWire.

We're a bit ambivalent towards the 650i. With ASUS offering the hybrid P5N32-E Plus and the onset of the 680i LT, performance wise 650i seems to be lagging, yet as far as price goes it's still in the game as it offers cheap access to SLI.

MSI's board comes with all the concessions made by transitioning from 680i to 650i – the single Ethernet port; two PCI-E x8 slots instead of PCI-E x16 (the primary port operates at 16x if you have only one card); support for eight USB instead of ten and four SATA ports instead of six. For most this won't be an issue, however power users will want to gear for a 965 or 680i board to increase the breadth of features. In a bout of niceness, MSI has also included optical and coax S/PDIF on the back, and thrown in eSATA for good measure. The board is also populated by solid capacitors, no doubt inspired by GIGABYTE's recent efforts in the field. We appreciate the extra longevity they give, let alone the fact that it's a lot harder to knock the suckers off by mistake.

Finally there's a parallel port on the back if you're still using a printer from the 80s. If you are, let us know your address so we may come and beat you. Parallel ports must die.

One advantage that the 650i holds over the 680i LT is that the board is passively cooled – MSI in this case opting for a heatpipe network rather than the simple passively cooled northbridge and uncooled southbridge present on competitor's boards. We're wondering exactly why the southbridge therefore needs to be cooled – perhaps the heatsink is there purely to siphon extra heat from the northbridge.

Regardless, silence is always a bonus in our books, provided that the board can still perform. If you find your overclocking limited, MSI has bundled in an optional northbridge fan, which is unfortunately quite high-pitched and loud.

The biggest disadvantage is of course the



“After a bit of tweaking, we managed to get the motherboard running solid at 380MHz, but it wouldn't boot at all above 400MHz.”

manual hardware switch needed for SLI – in essence a card between the GPUs that needs to be popped out and switched around whenever you want to change modes. Possibly this is down to the 650i's nForce4 heritage in that it uses the nForce 430 MCP, however in an age of software switching it's an annoyance we didn't expect.

Booting into the BIOS we found MSI's 'Cell' overclocking menu to be decent enough, and after a bit of tweaking we managed to get the board running solid at 380MHz, but it wouldn't boot at all above 400MHz. Annoyingly MSI's BIOS still tells us that the board doesn't support a 266MHz processor whenever the FSB is overclocked – it still works fine, but it's clearly a relic warning message from pre-266MHz bus days. Come on guys, get this fixed already.

Layout wise the board is great, the only potential conflict being that the battery is obscured by the graphics card, should you ever need to yank it out. The floppy drive port is also placed at the bottom of the board which may cause issues. In somewhat of a rarity these days, there are two IDE ports for those who need to support older hardware.

Despite its mainstream nature the board works well and delivers performance close to the flagship products, it's just not highly overclockable and even if MSI offers more than the norm, it is a little bare of feature. As we've said a number of times, if you're never going to go SLI, get a 965 board – they're much better value. If two NVIDIA GPUs are your thing and you don't intend to push the limits of your system, then MSI's P6N Platinum will be more than at home in your system. Ultimately the decision is your wallet's.

	EVGA nForce 680i SLI	XFX 680i LT SLI
Sandra Processor Arithmetic Dhrystone (MIPS)	27,100	27,174
Sandra Processor Arithmetic Whetstone (MFLOPS)	18,593	18,575
Sandra Memory Bandwidth INT (MB/s)	5,571	5,566
Sandra Memory Bandwidth Float (MB/s)	5,637	5,628
3DMark06	10,818	10,819

SCORE **8.0** OUT OF 10

MSI 8500GT, 8600GT OC, 8600GTS OC

Craig Simms raises a quizzical eyebrow at these cards, and asks: 'Why?'

SPECIFICATIONS

Price \$135, \$199, \$289
 Street Price \$145, \$215, \$309
 Supplier MSI
 Website www.msi.com.tw
 Specifications DirectX 10; 256MB;
 128-bit memory bus. For more
 detailed specifications on each
 video card, please check the
 table below.

Not content with letting Intel have all the fun putting the squeeze on AMD, NVIDIA has rolled out its mainstream DirectX 10 cards to flesh out the GeForce 8 family.

No doubt NVIDIA will eventually see the opportunity to fill in even more SKUs, with the extra GS, GX2, GP, GST, Gumbo and Gorbachev editions that tend to come along. Logically the market doesn't really need this many SKUs – it obviously works financially though, or NVIDIA and AMD wouldn't be doing it.

The parts in question are the 8600 GTS, 8600 GT and 8500 GT, all hobbled with a 128-bit memory bus. This indicates that they're positioned to pick up where the 7600 GT left off, but as you'll see from the subsequent benchmarks, things get interesting indeed, especially as far as the 7900GT is concerned.

These new GPUs use NVIDIA's 80nm process, bringing it up to speed with AMD's best. Check out the stats table – the 8600 GTS is even clocked higher than the 8800 GTX in terms of core, although the number of cut stream processors is significant between the models and will limit the effectiveness of this.

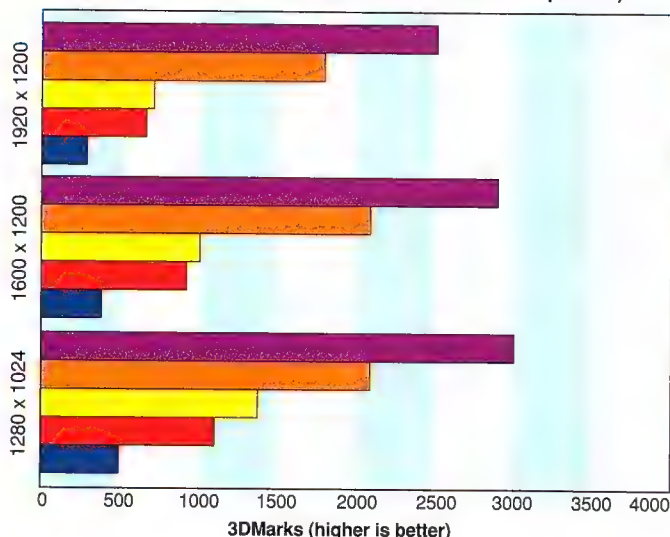
Also different is NVIDIA's VP2 chip – the 8800 GTX and GTS only feature VP1. It's there to help accelerate H.264 content a little better through the GPU – apparently being capable of offloading the entire decoding process, leaving the CPU to manage other areas of the process. This should be a boon to those with low-specced media centre systems.

The NVIO chip is gone as well, the cards being perfectly able to handle 2560 x 1600 output all by themselves.

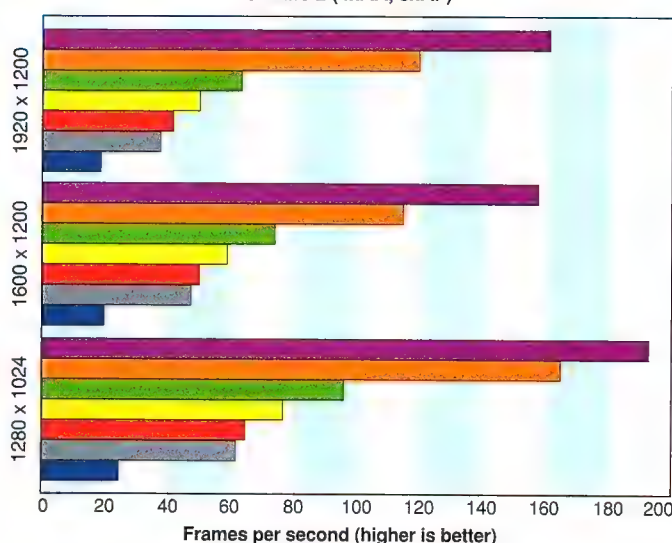


	7600 GT	7900 GT	8500 GT	8600 GT	8600 GTS	8800 GTS	8800 GTX
Core (MHz)	560	450	450	540	675	500	575
Memory (MHz)	700	660	400	700	1000	800	900
Stream processor speed (MHz)	N/A	N/A	900	1180	1450	1200	1350
Shader units	5 vertex shader units, 12 pixel shader units	8 vertex shader units, 24 pixel shader units	16 stream processors	32 stream processors	32 stream processors	96 stream processors	128 stream processors
Memory type	GDDR3	GDDR3	GDDR2	GDDR3	GDDR3	GDDR3	GDDR3
Memory capacity (MB)	256	256	256	256	256	320/640	768
Memory bus (bits)	128	256	128	128	128	320	384

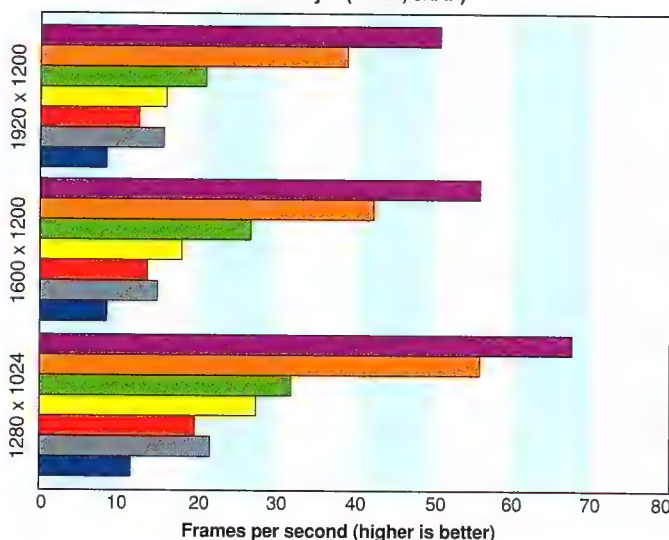
3DMark06 SM3.0 (4xAA, 8xAF, GeForce 8 series comparison)



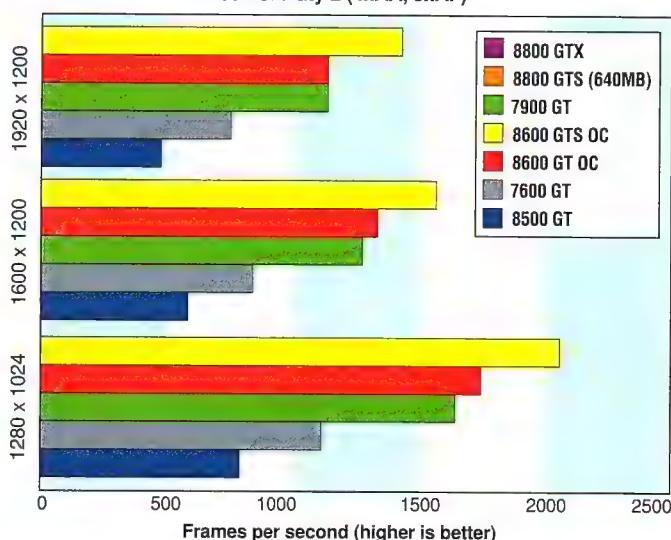
Half-Life 2 (4xAA, 8xAF)



Call of Duty 2 (4xAA, 8xAF)



Call of Duty 2 (4xAA, 8xAF)



Apart from these changes it really is business as usual – two dual link DVI ports and SLI are available on everything except the 8500; power is only required on the 8600 GTS; and DirectX 10 is there for the taking at a more affordable cost than in the past.

Unlike the early generation of the GeForce 8 series, the mainstream cards are available at launch as overclocked versions – in fact we haven't had a single vanilla 8600 cross our desks yet. In this case MSI's 8600GT has come in at 580MHz core and 800MHz mem, the GTS at 690MHz core and 1050MHz mem.

You'll also notice the street prices here are higher than the retail prices – this always tends to happen at a GPU launch, as demand outstrips supply. No doubt by the time you read this, prices will have normalised.

The 128-bit memory bus featured on all the cards was an unexpected cut, meaning that these new cards are really only competitive with the 7600 series, at least with AA turned on. Check out what happened with 3DMark06 when we switched it

off to enable comparison with the old generation cards on the SM3.0/HDR tests – both 8600s clear the venerable 7900 GT with ease. The poor AA performance on behalf of the 8 series cards compared to the 7900GT may have something to do with this restricted memory bus.

Of course we have no idea how these cards will perform in DirectX 10 games – we don't have any yet. Rest assured we'll return to these cards once Crysis lands in our hot little hands. For now, sit back and wait, as in DirectX 9 games these cards offer only a tiny advantage if you're hunting for premium image quality.

If you own a 7600 GT or below, don't care about AA or resolutions above 1280 x 1024, absolutely need to upgrade and are on a budget (whew, that's a few conditions), then the 8600 series of cards will fit the bill perfectly. We'd recommend staying away from the 8500 at all costs – this is one for your grandparent's machine.

For the rest of you who are looking to upgrade the 7900 GT, we suggest you stretch a bit further to the 8800 GTS 320MB edition instead, just to

be on the safe side – or wait for the 8800 GS that mysteriously just turned up in NVIDIA's drivers...

8500 GT



8600 GT OC



8600 GTS OC



XFX 680iLT SLI

The very generous Craig Simms gives 680i another try.

XFX 680iLT SLI

Price \$459 **Street Price** \$315
Supplier Multimedia Technology
Website www.mmt.com.au
Specifications Socket 775; 2x PCI-E x16; 2x PCI-E x1; 2x PCI; 1x Gigabit Ethernet; FireWire; optical S/PDIF; 4x USB; active cooling.

The 680i chipset has two Achilles heels. Crippling both heels usually brings someone down, but in this case it only made it limp slightly compared to the 965 boards – the rest of its muscles so to speak more than good enough to hold it up. The weaknesses in question are a northbridge that tends to overheat far too easily, and its extreme price – both of these have now been rectified with the 680i LT.

In a nutshell the differences are: A green board instead of black; the power on and reset buttons have been removed; SLI memory over 800MHz is not supported (though of course manual clocking works); a removed PCI-E x8 slot, a bank containing two USB ports and one Ethernet has been removed; and the most obvious – both north and southbridges are now actively cooled. While the southbridge fan is fine audio-wise considering its size, the northbridge possesses the most vociferous fan we've heard in quite some time, aurally assaulting our delicate eardrums. Tweakers in search of silence will want to replace it, stat.

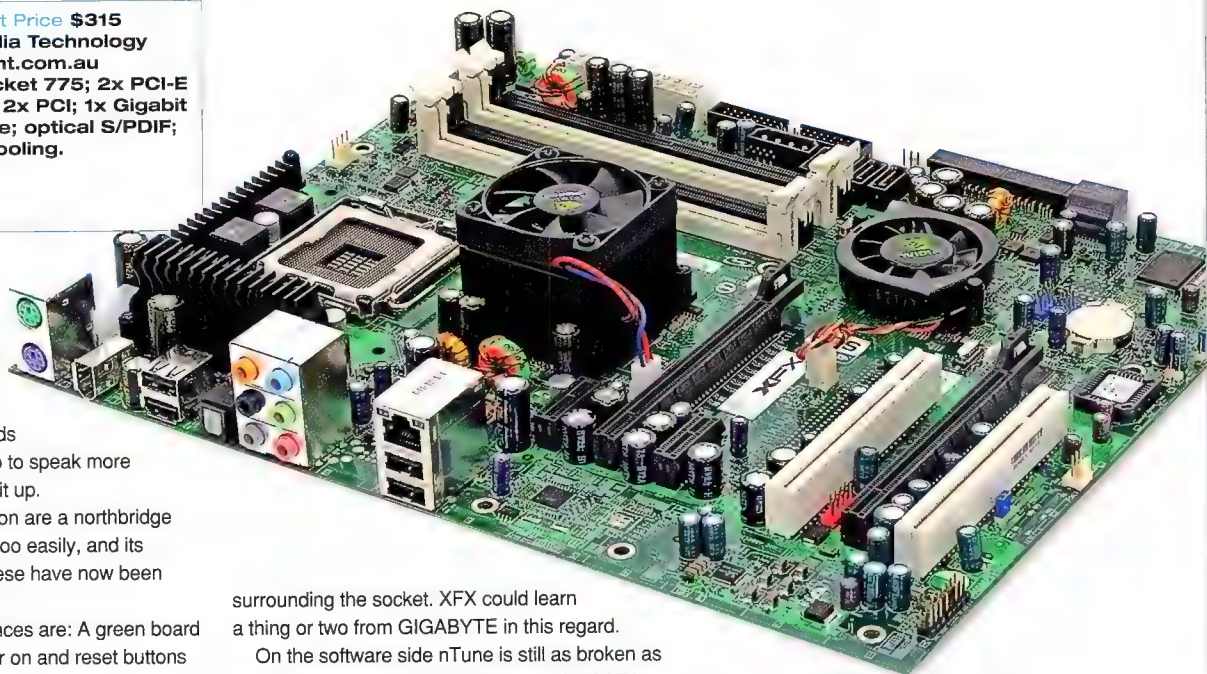
Otherwise this is for all intents and purposes the same board as the original 680i, right down to the bad placement of the front headers and the insane sizes of some of the capacitors

surrounding the socket. XFX could learn a thing or two from GIGABYTE in this regard.

On the software side nTune is still as broken as it's ever been since the BIOS updates for SATA corruption were issued, making it useless – we figure NVIDIA is a little busy trying to get decent Vista drivers running for its GPUs.

Speaking of BIOS updates – XFX's site simply doesn't have them, and is highly difficult to navigate in terms of its support options. Slightly worrying. EVGA offers them in EXE format, but this requires you to have a floppy drive. As both boards are essentially rebadges of NVIDIA-made, Foxconn-manufactured products we figured the BIOS would be interchangeable. Hitting the EVGA forums we were able to find an extracted BIN file for our update of choice, and rebooted into DOS courtesy of the Ultimate Boot CD, flash drive in hand and ready to, er, flash.

“On the software side nTune is still as broken as it's ever been since the BIOS updates for SATA corruption were issued, making it useless”



Sadly, it seems XFX has tagged its BIOS, meaning the EVGA flash won't work. Vexing. We'd just have to overclock with the default BIOS.

Fitting it out with the requisite X6800, 2GB of OCZ Flex XLC 9200 RAM, Western Digital Raptor and 8800 GTX, we got down to the dirty business.

Interestingly adding voltages manually didn't gel well with this board – we got more out of it by setting the voltages to 'auto', managing a maximum FSB overclock of 450MHz, rock solid. We're quite sure the board is capable of more, but it just wouldn't boot at a higher frequency. This is around 40MHz lower than we would have hoped.

As you can see below, the stock performance is spot on with that of the 680i, making the LT a much better proposition for those who want to get into SLI for a little cheaper. Mind you ASUS' P5N32-E SLI Plus, the hybrid 650i/570 board sells for a bit cheaper again, adds back in the PCI-E 8x, Ethernet port and heatpipes and unlike the 650i offers dual PCI-E 16x – so if you're not going to overclock much it might be worth going down this path. If SLI is not important, then grab a 965 board, as they tend to be better overclockers, cheaper and dare we say it, slightly better built.

The 680iLT is a good attempt by NVIDIA to try and lower the cost of its flagship mainboard product, but it's still not enough, and XFX really needs to work on its BIOS support if it wants to play in the motherboard game.

	EVGA nForce 680i SLI	XFX 680iLT SLI
Sandra Processor Arithmetic Dhrystone (MIPS)	27,100	27,174
Sandra Processor Arithmetic Whetstone (MFLOPS)	18,593	18,575
Sandra Memory Bandwidth INT (MB/s)	5,571	5,566
Sandra Memory Bandwidth Float (MB/s)	5,637	5,628
3DMark06	10,818	10,819

SCORE **7.5** OUT OF 10

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ASUS G2P

Craig Simms can only shake his head.

SPECIFICATIONS

Price \$3499 **Street Price** \$3072
Supplier ASUS
Website www.asus.com.tw
Specifications Core 2 Duo T7200;
 2GB RAM; Mobility Radeon X1700;
 Windows Vista; Realtek ALC882;
 MMC/SD/MS/Pro; 1394; 5x USB;
 DVI; VGA; S-Video; 120GB HDD;
 DVD-RW; Realtek PCI-E Gb NIC; 17"
 1440 x 900 screen; Bluetooth 2.

The ASUS G2 notebook is a bit of a monster. Styled in retro-futuristic red and carbon fibre black with an aluminium finish lid, it gives the feeling of a dreadnaught, poised to take on the likes of Dell's XPS M1710. The evil red glowing eye beneath the touchpad's buttons enhances this and, if it could talk, probably wouldn't actually say much of anything to add to its menacing countenance.

Things start well, being equipped with a Core 2 Duo T7200 and 2GB of 667MHz DDR2. It's also the first Vista notebook to sit squarely on our laps, with the 120GB hard drive handily partitioned into a 64GB system and 43GB data drive. Yes, we're well aware that doesn't add up to 120GB – a downside of formatted size versus non-formatted, or as a certain friend of ours would say: 'It munches the gigabytes'.

Connectivity wise the G2 is well-equipped, with FireWire, Bluetooth, four USB ports at the back and one on the side. There's also a limited set of memory card slots for the photography pundits, covering MMC, SD and MS/Pro. Below this is an ExpressCard slot, behind a physical switch for turning wireless on and off. There's even an IR receiver should you have a remote handy.

BIOS options as expected are quite limited – you won't be overclocking through hardware on this machine. It can get occasionally noisy as it vents hot air, but nothing that's annoying or beyond normal notebook volume.

The WASD keys are handily highlighted in red,



“The red lights flash like a Christmas tree when a DirectX app is loaded...”

and as a bit of a gimmick the red lights on the side flash like a Christmas tree whenever a DirectX application is loaded (read: games), something that can thankfully be turned off.

As for power consumption, a button gives you quick access to four profiles, so you can save your battery when you're not fragging.

The ALPS touchpad and software is decent, yet despite plenty of configuring, updating software and attempting to perfect our stroking technique (snigger), we could never get the vertical scroll to work first time, every time. Occasionally, left clicking on a dialogue box would make it lose focus, as if we'd clicked on the desktop instead of an 'OK' button – we assume this to be an odd Vista bug that will no doubt be resolved shortly.

In light of the scrolling issue we'd recommend a standalone mouse, and thankfully ASUS includes a rebranded Logitech MX518 to do the job. Also in the package is a rugged and well-designed backpack to store the laptop and other random stuff of your choosing.

The 17" screen is nice as well, even if the resolution is limited to 1440 x 900. ASUS tells us this was the only way it could reach the 2ms quoted response time – and indeed, movement looks great on this intergalactic space cruiser masquerading as a notebook.

In fact it seems the G2 has everything going for it really, until it comes to what it's actually built for

– video gaming.

This is down to one reason – the Mobility Radeon X1700 is an underpowered weakling in the notebook world, making us question its inclusion. While AMD's page lists an X1800 and X1900 Mobility (and an X2300!), it seems these chips are not available yet. So why didn't ASUS go with NVIDIA for more power? The lower-end 15.4" ASUS G1 certainly did, choosing the GeForce Go 7700 – for all intents and purposes a slightly better performing GPU. Dell's XPS M1710 on the other hand lets you load up a GeForce Go 7950GTX – admittedly at a significantly higher price, but at least the option is there.

We're not sure how ASUS would go about implementing a choice of graphics chip, but the chosen accelerator is steadfastly mediocre for a gaming solution – just look at how it stacks up against a year-old Dell configuration, a similar setup now costing slightly more than ASUS' offering.

When it comes down to it the G2P has all the makings of a brilliant gaming notebook, the package is excellent and it's good value – it just stumbles at the final and most important hurdle.

ASUS G2P	
3DMark06, 1280 x 1024, No AA, 8xAF (3DMarks)	2060
Super PI Mod (4M, time)	2m 30.566s
HDTach Burst Speed (MB/s)	132.2
HDTach Average Read (MB/s)	34.9
Half-Life 2, 1440 x 900, 4xAA, 8xAF (fps)	30.63

Dell XPS M1710 (Year-old config, Core Duo 2.16GHz, 2GB RAM, GeForce Go 7900GS, 17" 1920 x 1200, Hitachi 100GB)	
3DMark06, 1280 x 1024, No AA, 8xAF (3DMarks)	3274
Super PI Mod (4M, time)	2m 33.921s
HDTach Burst Speed (MB/s)	109.2
HDTach Average Read (MB/s)	42MB/s
Half-Life 2, 1600 x 1200, 4xAA, 8xAF (fps)	62.74

SCORE **7.0** OUT OF 10



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- PCI Express 16X

NX8600GTS-T2D256E-OC



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- 256MB DDR3 Graphic Memory
- Dual Link DVI & HDCP Support
- High Dynamic-Range(HDR) Support
- PCI Express 16X

NX8600GT-T2D256E-OC



- Powered by NVIDIA® GeForce® 8600GT GPU
- 256MB DDR3 Graphic Memory
- Dual-Link DVI for High Resolution Display
- High Dynamic-Range(HDR) Support
- PCI Express 16X

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Sapphire X1950 Pro Dual

Craig Simms finally crosses the line between sane and crazy.

SPECIFICATIONS

Price **\$599** Street Price **\$TBD**
 Supplier **Sapphire**
 Website **www.sapphiretech.com**
 Specifications **Dual X1950 Pro**
GPUs; 2x 580MHz core; 2x 700MHz mem; 2x 36 pixel shader units; 2x 8 vertex shader units; 2x 12 ROPs; 2x 512MB 256-bit GDDR3 memory.

The first words that come into your head: 'Dear God'. The second ones: 'Dear God why?' The third: 'Holy camel droppings on toast, Batman!' The X1950 Pro Dual is one of those special bits of hardware that comes along that you only see once every two generations.

The size, for a start, is nothing short of monstrous. Seriously, plugging the thing in is like hanging half a motherboard off your actual motherboard – with heatsink intact. This is the most worrying aspect of the card, its pure size means you'll definitely want to remove it from your case during transport or invest in a card stabiliser. Also worrying is that the size will severely limit what case the X1950 Pro Dual will fit in, at an elephantine 290mm long and 165mm high.

The reason for the size is hidden in the name of the card – it features two X1950 Pro GPUs – ATI's last mainstream runaway success. This means two power connectors, but more importantly, internal CrossFire is in action. Before you ask, yes, there are CrossFire bridges on the card. However quad CrossFire will only happen when (read: If) ATI ever decides it's of value to add it to its drivers.

The fact is that this is a Sapphire-only piece, rather than a device officially sanctioned by ATI. This means that Sapphire relies on ATI's drivers to detect CrossFire, and as the card's origin isn't ATI the drivers don't expect a dual-GPU card. Hence they do as they always have – hunt for a CrossFire compatible motherboard first. As a consequence unlike NVIDIA's 7950 GX2, this card won't work with its competitor's hardware.

We found this out the hard way as we put it into our EVGA 680i board, and sure enough the CrossFire option disappeared altogether from the Catalyst Control Center. Lesson: Don't stick it in a board that doesn't support CrossFire, or you'll suddenly find your hulking dual behemoth very single in the GPU stakes.

Popping it into the 965-based ASUS Commando and pairing it with an X6800 and 2GB of OCZ Flex XLC 9200 RAM, we set it to task in CrossFire mode.

While the Catalyst 7.4s were fine for 3DMark06, they despised Half-Life 2 and Call of Duty 2 when set to CrossFire, as did the 7.3s, 7.2s and 7.1s. There was also a lot of corruption during video playback, which led us to wonder if ATI had

thoroughly borked CrossFire again or if the card was at fault.

Switching to an ASUS P5B, the card exhibited the same problems – and after a quick word with Sapphire we determined that the card would need a 975 board, as apparently the 965 doesn't handle the required P2P transfers between PCI-E slots properly. Putting it into a Foxconn 975X7AA and rewiring it up, we eagerly installed the games again – for it to do exactly the same thing. It seems that for a number of games the card's a dead duck.

Interestingly, Windows detects the card as being able to power four monitors until you enable CrossFire – and sure enough you can spot the pinouts for two VGA connectors at the top of the board. Apparently the original card had passthroughs that would rewire these ports to an empty slot. This didn't make it through to the final product, although it would have been nice.

Assuming you can get it to work, there are only two remaining problems – the first is that the part just isn't DirectX 10, despite the impending update, meaning it's not future-proofed. The second is that the 8800 GTS is significantly better value, performs almost the same (at least in as far as we could benchmark) and always has the option of SLI.

The 7950 GX2 just worked, thanks to NVIDIA's great SLI drivers. Unfortunately the Pro Dual is slave to being a unique architecture not developed by ATI, yet requiring ATI's CrossFire drivers to work, which has usually been sketchy at best, doing things the traditional way.

Good in theory, but in practice, just too much can go, and has gone, wrong.



“As a consequence, unlike NVIDIA's 7950 GX2, this card won't work with its competitor's hardware...”

	Sapphire X1950 Pro Dual	8800 GTS 320MB
3DMark06 SM3.0 (1280 x 1024, 4xAA, 8xAF)	2877	2602
3DMark06 SM3.0 (1600 x 1200, 4xAA, 8xAF)	2296	2070
3DMark06 SM3.0 (1920 x 1200, 4xAA, 8xAF)	1017	1828

SCORE

4.0
OUT OF 10

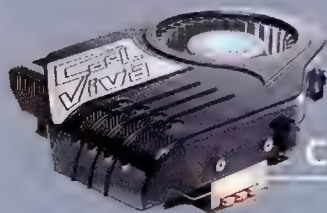


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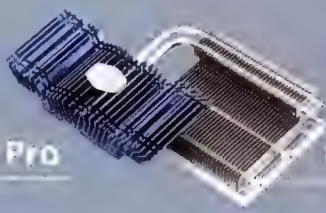


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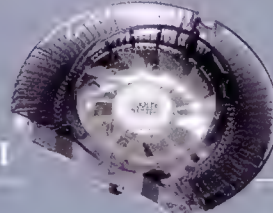
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Corsair Dominator TwinX2048 10000

SPECS

Price **\$TBD** Street Price **\$1016**
 Supplier **Corsair**
 Website **www.corsair.com**
 Specifications **2.4V; 1250MHz;**
2GB; 5-5-5-18 2T; EPP compliant.

Not letting OCZ get the last word in performance with its Flex XLC 9200 clocked at 1150MHz 5-5-5-15 2T, this month Corsair dropped on us its 10000 modules, rated at a blistering 1250MHz, 5-5-5-18 2T.

Like its previous Dominator models, Corsair has included a three-fan cooling solution that can be powered by any header on your motherboard. This is augmented by the tall black-finned heatsinks – but in all seriousness this will help little unless you're a crazily serious overclocker. Considering the price, that's clearly who these sticks are aimed at, so there's no problem here.

Plonking the 2GB's worth of sticks in our EVGA 680i and setting the default speed in unlinked mode, we hit 7147MB/s read, 4857MB/s write, 5531MB/s copy and 53.8ns latency in Everest. Obviously this could be pushed higher if you decided to increase the FSB instead of using unlinked mode. Unfortunately we couldn't push the sticks beyond the default speed or timings without it becoming Orthos unstable – quite possibly some

more voltage would have helped, but the EVGA tops out at 2.5V for DDR.

At 1066MHz 1:1 the sticks managed 7474MB/s read, 4849MB/s write, 5511MB/s copy and 56.6ns, courtesy of being able to screw down to 4-4-4-12 timings.

Oddly, like the OCZ 8500s and 9200s, the lowest the Corsair could get timing-wise at 800MHz was 3-3-3-3 1T also, netting 7930MB/s read, 4851MB/s write, 5507MB/s copy and 45.6ns using unlinked mode. Once again, opting to ramp up the FSB instead will achieve much higher speeds.

Corsair has taken the king spot again and

deserves major kudos for this engineering achievement. We look forward to the further speed insanity that ensues. Of course at this price, you'd have to be marginally insane or have the liquidity to play dodge-em-cars with a pair of Murcielagos – or possibly both. The rest of us will just have to stick to 800MHz.  **CS**

SCORE **9.0** OUT OF 10



SPECS

Price **\$699** Street Price **\$499**
 Supplier **Australia IT**
 Website **www.australiait.com.au**
 Specifications **2.3V (warranty for**
2.35V operation); 1066MHz; 2GB;
5-5-5-15 2T; EPP compliant.

It's interesting all the cross branding that's going on at the moment in the industry. Case in point: These new sticks from OCZ. We would have loved to have seen exactly how the deal was brokered to so blatantly plaster NVIDIA's logo all over the product in question. On the upside, at least we can be 100 percent sure the sticks are EPP-capable.

There's also a pair of ATI sticks out there with the CrossFire brand attached to it – although Lord knows what real benefit this has.

The black heat spreader is somewhat attractive, even if the perforated look is the norm for OCZ these days, and the 8500 rating means it clocks in at 1066MHz and does so at the 5-5-5-15 level, so it's no slouch on the speed front even at its defaults.

Putting both 1GB sticks into dual channel in our EVGA 680i SLI board netted us 7457MB/s memory read, 4869MB/s memory write, 5424MB/s memory copy and 59.1ns memory latency under Everest Ultimate Edition 3.5.

While the sticks wouldn't run 1066MHz at 1T

or with tighter timings and remain Orthos stable, the MHz themselves certainly did go up, right to the 1180MHz mark when using the FSB with a 1:1 ratio, giving 8114MB/s read, 5372MB/s write, 6031MB/s copy and 54.2ns latency. Unfortunately relaxing the timings didn't allow us to hit 1200MHz stable. It's going to be interesting to see when we'll hit the 1333MHz mark – place your bets on whether DDR2 or DDR3 will reach it first.

Bumping down to 800MHz using unlinked mode, we were able to hit 3-3-3-3 at 1T, giving 7937MB/s read, 4851MB/s write, 5477MB/s copy and 54.7ns latency – so better to go for the high

speeds here rather than the low latency – or better yet, push your FSB and drop your CPU multiplier if you're able, and stick with the low latency.

If you have to have everything branded by NVIDIA or just want some decently fast sticks at an almost reasonable price, then these 8500s are a pretty good deal. It's not quite as insane as the Flex XLC series, but then we're pretty sure nothing is.  **CS**

SCORE **8.0** OUT OF 10



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ASUS GeForce 8800 GTX AquaTank

SPECS

Price **\$1149** Street Price **\$TBD**
 Supplier **ASUS**
 Website **www.asus.com.tw**
 Specifications **630MHz core;**
1030MHz memory; 768MB
GDDR3; DirectX 10 compatible; 2x
dual-link DVI; water-cooled.

The GTX overclocking era is on us – made all the more obvious by ASUS' huge offering here. The yields are just right for NVIDIA now, meaning it can squeeze more speed out of the chips. We just feel sorry for AMD with nothing yet to show.

The AquaTank takes up a lot of space – four slots total, so be prepared to lose a lot in return for the privilege of water-cooling. Opting to bundle in a Thermaltake Tidewater, which combines reservoir, radiator and fan in one, ASUS has also added another fan to the graphics card itself – making this card a noisy affair despite the fan throttle on the Tidewater. As half the point of water-cooling is to reduce noise, this is a little worrisome.

The other part is to reduce temperatures so clock speeds can be increased. In previous overclocking attempts, we couldn't get our reference GTX above 630MHz core, from a default 575MHz. This is on air, and was quite stable.

The AquaTank starts at 630MHz, with a memory speed of 1030MHz, a good 130MHz above stock. The cooling did well, keeping it to 53°C at idle and

71°C at load – a slight improvement. Assuming this would open the door to further goodies, we jumped into nTune. With a bit of fiddling we were able to raise the speed to 655MHz core and 1103MHz mem, satisfying NVIDIA's test mode – however this wasn't stable when running 3DMark06, leading to nothing but hard crashes. In fact not even the smallest overclock would run through an entire 3DMark06 test – making the water-cooling effectively useless in that it's noisy, doesn't afford extra performance than air and takes up a ridiculous amount of space.

At its stock speeds it scored 3939, 3206 and 2853 at 1280 x 1024, 1600 x 1200 and 1920 x 1200 respectively in 3DMark06 – around 17%

faster on average than your default GTX.

It's hard to recommend this over XFX's air-overclocked 630MHz XXX Edition, or buying a vanilla card and doing it yourself. Simply put, the AquaTank isn't a sensible purchase. **CS**

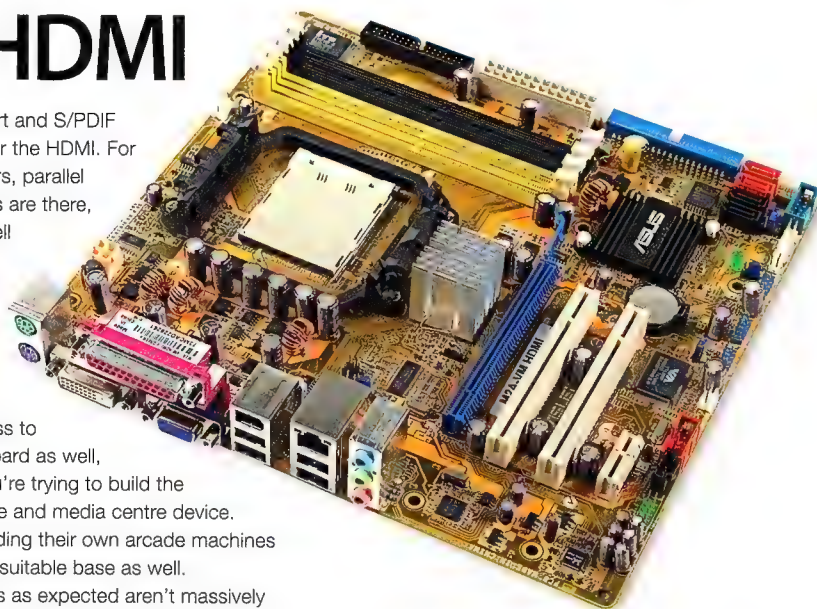
SCORE
5.0
 OUT OF 10

slots, a DVI port and S/PDIF passthrough for the HDMI. For the legacy users, parallel and serial ports are there, meaning it's well positioned as an upgrade board too.

ATI's SB600 chipset means you have access to RAID on the board as well, just in case you're trying to build the ultimate storage and media centre device. Those into building their own arcade machines may find this a suitable base as well.

BIOS options as expected aren't massively expansive, with voltages in particular lacking flexibility. Using an FX-62 with the multiplier clocked down to 6x, we couldn't set the FSB any higher than 230MHz without the board locking up, although Windows was perfectly stable at this speed. Something for a BIOS revision to fix in the future perhaps.

Once again this really isn't a problem considering the board's target market, and the price is incredible when you consider what it includes.



ASUS M2A-VM HDMI

SPECS

Price **\$129** Street Price **\$126**
 Supplier **ASUS**
 Website **www.asus.com.tw**
 Specifications **AM2; 1x PCI-E x16;**
2x PCI; 1x PCI-E x1; 4x USB;
Gigabit Ethernet; DVI; VGA; HDMI;
parallel, serial.

Micro-ATX boards are all the rage for media centres these days (unless you're one of those that likes to shoehorn a mini-ITX board into, well, a shoe), and if you're interested in building a box for watching what's on the box, you may appreciate the HDMI/component riser card featured on ASUS' new board, based on AMD's new 690G chipset.

The onboard graphics are driven by the Radeon Xpress 1250 – so not flash by any standard (it doesn't even support Shader Model 3.0, for example and is a true dinosaur), but

certainly fine from a media centre point of view. If you're worried about this you can quite easily throw in an updated card, although you'll lose the HDMI port as a result of employing the PCI-E x16 slot.

Other standouts of the board are four DIMM



Considering AMD's massive price cuts of late, you can get a pretty darn powerful CPU in there as well.

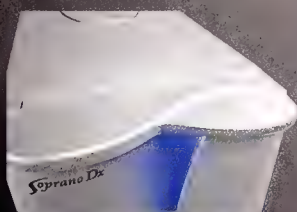
ASUS + AMD = Win. **CS**

SCORE
9.0
 OUT OF 10

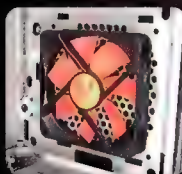
Soprano Dx

Dangerous curves

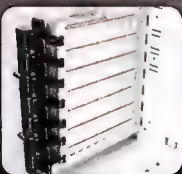
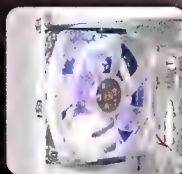
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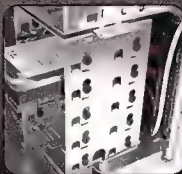
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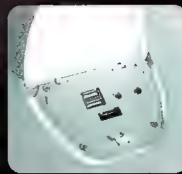
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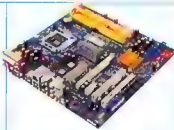
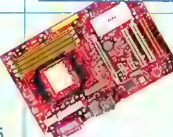
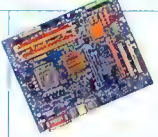
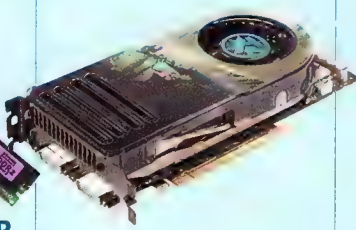
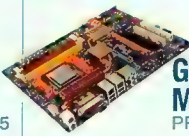
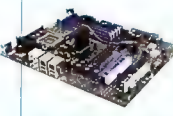
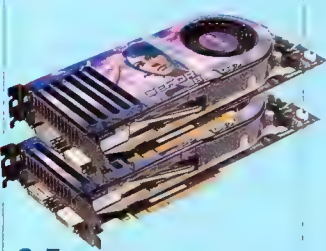
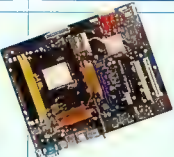
ATOMIC KITLOG

Our choice for
the best gear the
land has to offer

There's nothing sexier than new kit. And whether you need to horde your pennies (Budget), want the most power for your dollar (Performance) or own a small mansion and

a collection of sports cars (Extreme), we're here to help with this handy matrix of *Atomic* recommended products. You may find your needs fall between categories – that's okay,

just mix and match to suit your budget! Each piece of kit has been reviewed hands-on in *Atomic*, so if you want to learn more, look up the issue and page number listed.

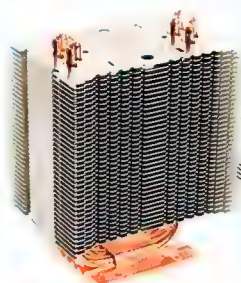
		CPUs	Motherboards	Memory	Video cards
BUDGET I can't afford to eat... gimme gear!	intel	 Intel Core 2 Duo PRICE \$200-\$480 Stretch a little further and buy yourself a Core 2 Duo – you'll be thanking yourself later. The E4300 is the cheap ticket to speed, at \$200.	 ASRock Conroe 945G-DVI PRICE \$113 ASRock's budget board may be using old technology, but it runs the new stuff just fine, and can even overclock a little. <i>Reviewed in Issue 70 – Page 60</i>		
	AMD	 AMD Athlon 64 AM2 X2 PRICE \$135-\$335 Cheap CPUs are a wonderful thing, and the X2s are now wonderfully cheap. The 3600+ LV is your budget baby at about \$135.	 MSI K9N Neo F PRICE \$113 Excellent performance from a budget board, with plenty of legacy slots for upgraders. Don't expect to overclock though. <i>Reviewed in Issue 68 – Page 33</i>	Corsair Twin2X 1024MB 6400 Pro PRICE \$198 Corsair has a history of providing nice, stable and feisty sticks of random access memory joy. These RAM sticks are EPP compliant, have low latency and are nicely overclockable. 800MHz of fun for everyone! <i>Reviewed in Issue 69 – Page 51</i>	Powercolor X1950 Pro PRICE \$245 The X1950 Pro is nothing short of fantastic. Mind you, this could just as easily be the 7950GT, so watch this space in case the NVIDIA card drops in price. <i>Reviewed in Issue 71 – Page 47</i>
PERFORMANCE Hardware that bangs the best for buck.	intel	 Intel Core 2 Duo PRICE \$200-480 Core 2 Duo – crazy fast, crazy cool, crazy affordable, overclockable like buggery. The E6420 is the best buy, at about \$300.	 Gigabyte GA-965P-DS3P PRICE \$204 The 965P-DS3P is a ridiculous overclocker that can't be ignored. Buy a low-end Core 2 and go nuts! <i>Reviewed in Issue 74 – Page 46</i>		
	AMD	 AMD Athlon 64 AM2 X2 PRICE \$135-\$335 The X2 series are still fantastic chips, and in the face of the Intel threat are now going for cheap. The 6000+ is your current sweet spot at about \$335.	 Gigabyte GA-M59SLI-S5 PRICE \$250 Gigabyte delivers yet another affordable, feature-filled wonder of the 21st century. <i>Reviewed in Issue 66 – Page 39</i>	Corsair Twin2X 2048MB 6400 Pro PRICE \$350 Yes, these are the same sticks recommended for the Budget system. Sadly, they are also the only RAM sticks we've tested that are compatible with AM2 and Conroe. So until we get more in, the Corsairs will stay. <i>Reviewed in Issue 69 – Page 51</i>	GeForce 8800GTS 320MB PRICE \$410 DirectX 10 for the mainstream. 320MB is as good as 640MB in most situations – opt for the 640MB if you're going to play above 1600x1200. <i>Reviewed in Issue 76 – Page 58</i>
EXTREME Gimme power. Money is no object.	intel	 Intel Core 2 Quad QX6700 PRICE \$1337 It may be clocked slightly slower than the X6800, but it overlocks fine and has double the cores! <i>Reviewed in Issue 72 – Page 46</i>	 EVGA nForce 680i PRICE \$435 Stupidly over-featured and fast, if you've got the cash, then plonk it down here. <i>Reviewed in Issue 72 – Page 47</i>		
	AMD	 AMD Athlon 64 FX-62 PRICE \$1072 Sadly gets beaten by a mid range Core 2 Duo, but still the top of AMD's pile. <i>Reviewed in Issue 66 – Page 39</i>	 ASUS M2N32 SLI Deluxe PRICE \$290 Perfection in a motherboard. Beautifully laid out and overclockable to boot. <i>Reviewed in Issue 68 – Page 35</i>	Corsair Dominator Twin2X 10,000 PRICE \$1016 Crazy speed sticks that will also happily do 1T/800MHz/3-3-3-3. Comes with a fan attachment to keep things cool! <i>Reviewed in Issue 77 – Page 58</i>	GeForce 8800GTX SLI PRICE \$810x2 The next generation is here, and it kicks arse. While we're still waiting for DX10 applications, for DX9 the thing utterly destroys the competition, providing you have a beastly CPU. <i>Reviewed in Issue 72 – Page 30</i>

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It may only be 90mm, but its cooling power is exemplary, coming in only slightly behind its 120mm brother.

Reviewed in Issue 72 - Page 42

System drives



Samsung HD160JJ
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PRICE \$80

Super quiet and yet still fast, the 160GB Samsung offers excellent value for money.

Reviewed in Issue 69 - Page 40

Displays



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2ms of raging colour gamuts and beautifully smooth tonality that will make you weep with joy and hug strangers.

Reviewed in Issue 70 - Page 56

Speakers



Steelcase 5Hv2
PRICE \$120

Awesome gaming audio performance on a shoestring budget. Phenomenal 'phones.

Reviewed in Issue 73 - Page 43

Cases



Cooler Master Ammo 533
PRICE \$92

Perfect for LANs with its heavy duty handle, military styling and rugged construction, the Ammo blasts the budget competition away.

Reviewed in Issue 60 - Page 50

Thermalright Ultra 120
PRICE \$75

Tower cooling that will keep your tower cool. Whack a Nexus 120mm fan on for near silent cooling.

Reviewed in Issue 72 - Page 42



Seagate Barracuda 7200.10 320GB
PRICE \$130

Seagate's fancy new technology makes this beast both fat and fast. Mmm, toasty.

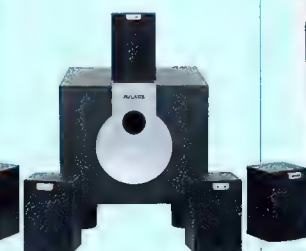
Reviewed in Issue 69 - Page 40



Samsung 244T
PRICE \$1477

Brilliance at 24", the 244T offers 6ms gaming, a wonderful gamut and more inputs than an alien hooker.

Reviewed in Issue 69 - Page 48



AVLabs AVL325
PRICE \$165

While it can't hold a candle to the Z-5500D, with a price this low there's no excuse not to jump to 5.1.

Reviewed in Issue 64 - Page 50



Cooler Master Stacker 830
PRICE \$290

Like the Stacker before it, this sensational Stacker stacks sumptuous specifications salaciously.

Reviewed in Issue 61 - Page 36

Thermalright Ultra 120
PRICE \$85

Make sure you get the optional AM2 bracket (hence the higher price). Grab that same Nexus fan.

Reviewed in Issue 72 - Page 42

Asetek Vapochill Lightspeed
PRICE \$1020

Vapour phase change. Oooh. Vapour. Phase. Change. No matter how many times you say it, it's still cool (pun!)

Reviewed in Issue 64 - Page 38



Western Digital Raptor WD1500ADF
PRICE \$330x2

Dear lord. The performance king hath cometh, short of whacking in a SCSI. Buy two and RAID 'em.

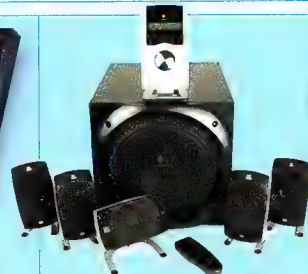
Reviewed in Issue 62 - Page 40



Hewlett Packard LP3065
PRICE \$2718

Thirty inches, 2560 x 1600, 8ms G2G. If you can handle the size and cost to run this massive beauty, you won't be disappointed.

Reviewed in Issue 76 - Page 53



Logitech Z-5500D
PRICE \$430

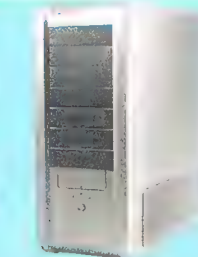
Able to play the 'liquid gold' that is DTS 96KHz/24-bit, this 5.1 beast can wreck both home and hearing alike with equal impunity.

Reviewed in Issue 48 - Page 56

Cool-Trek Vostok
PRICE \$199

Until more extreme cooling systems come along that are AM2 compatible, this little kit will have to fill the gap. Make sure you get the updated mounting kit.

Reviewed in Issue 68 - Page 41



Silverstone TJ07
PRICE \$420

The Silverstone Temjin TJ07 is a huge hulking beast that shows you mean business in the finest style. Impeccable finish and plenty of room means win.

Reviewed in Issue 65 - Page 49



Doughnut-shaped universes

Daniel Rutter explains how that crazy universe in Asteroids really works.

The topology, or 'shape', of the universe, is a serious area of science that often gets boiled down into newspaper-science factoids that tell you just enough to leave you dumber than you were when you started reading.

The idea that the whole fabric of space-time may, itself, be describable as having a shape, is confusing. Until you realise that practically every player of video games already has experience with funny-shaped universes.

A chessboard, or the 'board' of most strategy and shooter games, is finite and bounded. Units can't go past the edge, and that's that.

But lots of games have wraparound, and that's your gateway into cosmological topology. Wraparound allows you to make a finite, but *unbounded*, playfield.

The simplest unbounded playfield design used in computer games is the cylinder. That's Pac-Man wraparound, where what goes off the left side of the screen comes back on the right, as if the two edges were connected together with the playfield bent around into a tube.

More common, though, is the torus, or doughnut. Toroidal wraparound is your basic Asteroids layout, with left connected to right and top connected to bottom. Topologically speaking, you're playing your game on the surface of a doughnut.

The advantage of toroidal 'space' is that, from the point of view of the little dudes on the screen, it's still 'flat'. Geometry works normally; triangle angles still sum to 180 degrees. Nothing tricky has to be done in the programming, no internal doughnut surface model needs to be maintained – just transfer coordinates between the connected edges, and you're done.

This means you can map a toroidal playfield perfectly onto a flat display, and everything will work quite intuitively.

Almost all humans, in contrast, live on the surface of a sphere.

A sphere's surface is not, geometrically speaking, flat. It's curved. Draw a little triangle on the surface of a sphere and its angles will very nearly sum to 180 degrees, but the further you extend the sides, the larger the sum will become. If the triangle covers a quarter of a hemisphere, its angles will each be 90 degrees!

This, in essence, is why it's geometrically impossible to properly map a sphere onto the flat square display devices we use for games, or indeed onto a paper map. That's why there are so many different kinds of world map 'projections' out there. Each projection has a different set of tricks for stretching, squishing or tearing the real planet, and putting the worst of those places where they don't matter too much. Like the poles, the middle of the ocean or Adelaide.

All of this is a bit too much trouble to go to in a game, particularly when you realise that all it buys you is confusion when, for instance, a unit goes as far north as is possible and now faces a wide selection of possible

'souths'. So practically every game with a wraparound world – even if it pretends to have a spherical map when you zoom out – actually uses a good old doughnut.

Anyway, thanks to computer games, you understand the basic concepts of cosmological topology. Questions about the shape of this universe or any other hypothetical one are actually questions about its flatness, finiteness and boundedness.

It's perfectly possible for space to be unbounded but not infinite, if it wraps around in one way or another. And it's also perfectly possible for space to not be flat,

so that the simple Euclidian geometry that works fine for us on the small scale of our everyday lives comes apart when we start talking light years.

So the next time you read some muddled article about how the universe is shaped like a tuba or something, you can explain it to anyone who asks in terms of Command & Conquer, Asteroids, and the Mercator Projection.

Hmm. At least you'll know what you mean.

Dan wants to live on a planet that's shaped like a triangle. At least we think that's what he wants...

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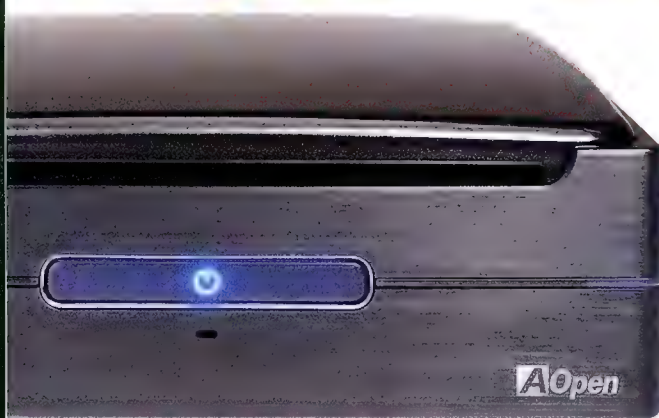
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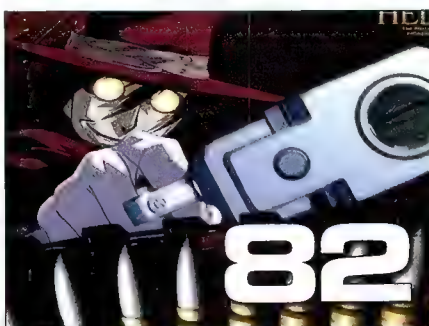
GAMEPLAY

GAMES, GAMING AND GAMERS COVERED ATOMIC-STYLE

BioWare has been pretty quiet of late. With properties such as Neverwinter Nights 2 outsourced to Obsidian Entertainment, the developer has had a lot of time on its hands to play around with a few ideas, like the critically-acclaimed Jade Empire. Now it's got its sights set on a sci-fi action RPG, called Mass Effect, using Unreal Engine 3 – a huge departure from

the fantasy-focused games it has worked on before. We had a chance to talk to BioWare about its upcoming game, and it had a lot to say.

Command & Conquer 3 also struck this month and all we have to say is: It's competent. Not exactly exciting stuff, but fans of the series should definitely turn to page 76 for the full story.



GAMEPLAY CONTENTS

Engine Room: Mass Effect 70

BioWare's at it again, but this time it's decided to really have a go at a full-blown sci-fi action RPG. Logan Booker finds out why Mass Effect looks and sounds totally sweet.

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Kate Inabinet wants to stop the dogs from eating the kids.

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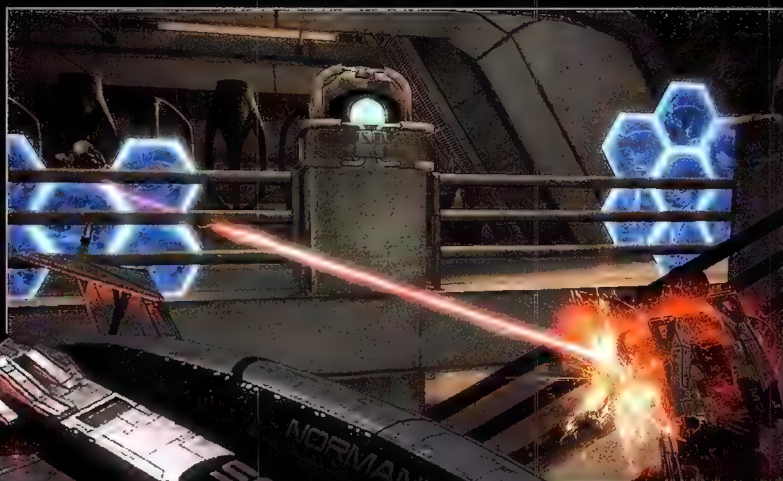
5x copies of Hellsing Ultimate to be won!

www.atomicmpc.com.au/competitions

Alucard, the rogue vampire working to protect England from the growing threat of undead is back, along with a new, beautiful, vampire companion called Seras – if undead can be sexy. It's up to Alucard to combat the forces of the evil Father Alexander Anderson and stop his hordes from destroying all life.

If you'd like to be in the running to win a copy of *Hellsing Ultimate*, just head on over to the competitions URL above and answer the question you find there. Thanks to Madman (www.madman.com.au) for this great prize.





BioWare has an illustrious career in the genre of PC role-playing games; a genre the company itself has had a serious hand in shaping. Yet, looking over the list of titles BioWare has released since its founding in 1995, it's quickly obvious that the developer has relied heavily on the tools of other intellectual properties – Dungeons and Dragons, Star Wars and MDK – to carve its success on the tablets of gaming history. It wasn't until Jade Empire in 2005 that BioWare really struck out on its own – and risked it all by leaving the sanctuary of the PC for Microsoft's aging Xbox. After blowing away the console crowd with its combination of action and role-playing, it took two years for the game – and BioWare – to make it back to the company's proving grounds of the PC.

With the success of Jade Empire, BioWare shifted from regurgitating the IP of others to generating its own and in the process offloading its tried-and-true brands of Neverwinter Nights and Knights of the Old Republic to other developers, most notably the Feargus Urquhart-run Obsidian Entertainment. With new-found time to burn, BioWare started work on

Critical mass

Logan Booker invited BioWare's Casey Hudson onto the Starship *Atomic* to negotiate the release of information on the developer's new action RPG, Mass Effect.





Mass Effect, a sci-fi RPG that looks to break even more of the rules the company itself spent a decade setting in place.



IN THE BEGINNING

Mass Effect is set roughly 200 years in the future, according to project director Casey Hudson at BioWare. After discovering an ancient alien technology on Mars that allows faster-than-light travel, humanity takes its first tentative steps outside the Solar System. Humans quickly spread throughout the galaxy, establishing colonies and building bases with the aid of FTL, as well as special gateways called 'mass relays', which allow the traversing of large distances in seconds. Of course, no human colonisation of places unknown would be completely without a bit of hostility, and ten years into its expansion humanity meets, and promptly starts warring with, a bird-like race known as the Turians.

It's at this point that the Citadel Council, an organisation that moderates intergalactic relations, steps in to quell the fighting and recognise humanity's claim to its little bit of the galaxy. Mankind discovers it is just one of half-a-dozen species in the known universe, itself a fledgling entry into the galactic community.

The player's role in this developing story is that of Commander Shepard. Shepard is classified as an 'N7 Elite', making him one of the military's deadliest, most efficient and veteran combatants. As per the standard RPG plot (with

minor flavour changes), the universe is in peril from an age-old civilisation that 'harvested' the galaxy to death millennia ago, and it's up to Shepard to stop history repeating.

'The rest of the back story is actually up to you,' explains Hudson. 'You decide what happened in your past to put you where you are at the start of the game. Did you establish yourself through heroic or ruthless reasons? What kind of upbringing did you have? These choices will affect the first impressions people have of you throughout the game.'

At this point you'll also be able to mould Shepard's physical appearance and skill set. Along with the choice of a male or female character, players can alter Shepard's facial features and specialise in one of six fields. This field will determine what abilities Shepard will have access to during the game.

The first three fields – the Soldier, Engineer and Adept – are pure in their specialisation, providing exclusive access to weapons, technology and magic (or 'biotics') respectively. The last three fields are simply a combination of these; the Infiltrator being a hybrid Engineer/Soldier, the Sentinel a mixture of an Adept and Engineer while the Vanguard blends the abilities of the Soldier and the Adept. In many ways this approach mirrors that of BioWare's older Knights of the Old Republic.

'Mass Effect is as deep as our past games in a role-playing sense, allowing players to create and customise their own character, and develop an entire team of characters over the course of the game,' says Hudson.

Above: Ever seen a more uncomfortable-looking suit? **Above centre:** Just because you're an alien doesn't mean you get special treatment. **Above far left:** In the future, people still hide behind walls like little girls during a firefight.

Below centre: With a light that bright, how on Earth can it see? Oh, wait... **Below:** What did you expect, turning up late to the party?



“With a ‘cryo mod’ applied to a weapon, it allows you to freeze targets in their tracks, leaving them at your mercy.”

BUILD EM’ UP

An experience point system will be available to improve Shepard’s talents and abilities to unlock new weapons and attacks, as determined by your selected field. Although Hudson did not go into great detail as to how this system will operate, he did mention a few related tidbits.

‘As a soldier, you will develop an awesome arsenal of weapons and some amazing special abilities such as Carnage, where you can handle an overloaded shotgun to deliver a devastating close-range attack. On the other hand, Sentinels can create chaos on the battlefield by throwing objects around, disabling enemy weapons, and turning enemies against each other. Each character class gives you a different blend of talents, creating very different types of combat gameplay.’

Other examples of talents include everything from the simplistic – Pistols, First Aid, etc – to the complex and powerful – Shielding, Sniper Rifles and the mysterious sounding ‘Singularity’, available to those who specialise in biotics.

While Shepard is indeed a tuned killing machine, he won’t be going it alone in his crusade to defeat unfathomable evil. Along with the man himself, two other characters can accompany Shepard at any one time, controlled via a very Ghost Recon-like order system or, as seen on the gameplay videos available at BioWare’s Mass Effect site, a 2D overlay reminiscent of a top-down turn-based strategy. Eventually the player will be able to select from six associates to fill out their team.

‘You’ll be able to customise [your squad’s] development as well. You’ll also find, buy and sell lots of different kinds of equipment so that your squad can be outfitted with your choice of weapons, armour, helmets etc.’

On top of this, your equipment can undergo more refinement, Hudson providing the example of a ‘cryo mod’ that, when applied to a weapon, allows it to freeze targets in their tracks.

SPACE LANES LESS TRAVELLED

Below: If that face doesn't kill you, the gun will.

When we questioned Hudson on the linearity of the game, he was more than happy to describe BioWare’s plans.





Essentially, the developer will be blending the story-driven gameplay of titles such as *Neverwinter Nights 2* with a more fleshed-out version of the flexibility glimpsed in *Knights of the Old Republic*, where the player could direct their space-faring vessel to a variety of planets.

'Mass Effect is extremely non-linear, giving players a true sense of freedom and control over how their story develops. The game itself is really a collection of locations in space, each with its own sub-plot within the main story arc. So you're able to travel to any of these locations as you wish, though of course some of them unlock over time as you reveal more of the main story,' says Hudson.

Each planet or sub-plot can be explored in any order, and once you head to a planet, you're not locked into it for the duration of its story. You can pack your bags at any time (violent events permitting) and blast off to another location.

Speaking of interplanetary travel, Shepard will have at his command a 747-sized starship called the 'Normandy', and from what we can deduce, will act as a base for Shepard and his team.

No definitive information is available on how flexible the game will be in regards to transportation, including loading screens and related immersion breakers. Hudson however did describe to us a recent play through where he drove a vehicle through a snowstorm and into the ship's hanger, where he was then able to hop out

and run through the interior of the ship and up to a hologram of the galaxy, which allows you to navigate to each planet. Hudson used the word 'docked' to describe the status of the ship while it was terrestrial, so we can only assume there are fixed places in which to land – so freeform *Frontier*-like landing and take-off seems out of the question. On the upside, the game will have driveable vehicles.

ENGINEERING, REPORT!

Like many upcoming games, including *Auran's Fury*, *NCSoft's Huxley* and *BioShock* from Irrational, *Mass Effect* will use Epic's Unreal Engine 3. Hudson explains that licensing an engine instead of BioWare making its own was the only way the game would have been completed in a reasonable time frame, considering the quality and scope BioWare was aiming for.

Not everything is pre-packaged however, as Hudson explains.



'On top of [Unreal Engine 3] we've built our largest programming project yet at BioWare: the proprietary digital actor, cinematic storytelling, and character development systems, required to make a next-gen BioWare game, plus a number of *Mass Effect* specific components like the explorable galaxy system.'

The dialogue system, or 'cinematic storytelling' as BioWare describes it, is perhaps the most advanced feature the developer has designed and in a departure from its previous games, players will choose 'gut instincts' instead of fully articulated replies during conversation. BioWare explains that this is to better reflect true conversation, where you have an idea what you want to say, just not the exact phrasing. According to the company, in testing this has resulted in more 'cinematic' and free-flowing dialogue.

From the screenshots it is easy to see that BioWare has used every graphics trick in the book and pushed the resources of the platform lead, the Xbox 360.

'In many ways, *Mass Effect* is a spiritual successor to our previous title, *Knights of the Old Republic*. As an Xbox game (and later a PC game), it was natural to take *Mass Effect* to the next-generation Xbox,' says Hudson.

'We also really enjoyed developing for the Xbox, and the 360 has turned out to be an amazing system. It's a graphical powerhouse, has a highly polished online experience, and is set up to provide a premium high-definition experience right out of the box.'

How exactly the company has managed to make the game look this good on a console can only be

Above: Imagine getting a headbutt from this guy...

Above centre: A solid contender for the galaxy's saddest alien.

Below: Jeeps, space ships and blue chicks – what more do you want?



Right: See, you've gone and made him angry now.

put down to Unreal Engine 3 and the tireless work of BioWare's artists. According to Hudson, the game makes heavy use of normal mapping and BioWare has stated that each character model will use 20,000-25,000 polygons.

Physics is another area BioWare has been tweaking, Hudson mentioning vehicles with six wheels – all with independent suspension and physics modelling – and abilities like the Singularity power we brought up earlier, which creates a black hole that pulls loose objects towards enemies.

'But these technical features are really all to support a higher goal: Immersing the player in a story-driven experience that feels real enough to really care about,' says Hudson.

APPROACHING WARP SPEED

Despite being an Xbox 360 exclusive title, BioWare decided not to pursue a multiplayer component even with the tantalising carrot of Xbox Live hanging in the air. According to Hudson, BioWare wanted to focus on the singleplayer aspects of the game and not risk compromising the quality by shoe-horning in MP.

'There are lots of games where you can do head-to-head multiplayer, but we were interested in creating a definitive experience that puts the player at the very centre of an incredibly deep and non-linear story experience, where the game responds to each of your actions in a way that really can't be done when other players compete for centre stage.' Hudson however did not rule out MP entirely, the option still



open for the second and third games BioWare has sketched out for the franchise.

Along with multiplayer, Mass Effect will have no support for modding, which is not surprising considering the limited environment of the Xbox 360 for this type of activity. BioWare currently has no plans for a PC version, so we may never have the opportunity to play around with inner workings of the game.

This could be considered quite an oversight, considering the longevity of BioWare's Neverwinter Nights can be placed solely on the shoulders of the Aurora toolset that came with the game – websites such as NWWVault (ign.nwwvault.com) being proof of this fact.

Regardless, Hudson believes Mass Effect has enough draw to overcome these shortfalls.

'I think there are a few different things that will initially attract players to Mass Effect. We've asked this of players in our online community, and the results are interesting. Some people are very interested in creating their own character ... others are interested in playing a richly non-linear story ... lots of players want to jump into the combat and blast their way through challenging tactical battles, and yet others will want to explore the galaxy and discover their own stories,' Hudson explains.

'But I think what makes people keep playing is what happens when you have the freedom to do all of those things at any time. That freedom means that it's your game – truly your own unique experience in this universe.'

Hudson says that BioWare is getting 'very close' to completion of the title, the game playable from beginning to end. Most of the work now is focused on polishing the title. ■



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Go, team, off to do something important like save the world

Command & Conquer 3: Tiberium Wars

Logan Booker wants to have Grace Park's babies.

Given one word to describe Command & Conquer 3, our list of potentials would not include 'Amazing', 'Revolutionary' or even 'Carrots'. Perhaps if we were to become slightly drunk, or swig a pint of nutmeg suspended in water, the chances of these words being added to our list would improve dramatically. Unfortunately for EA, with neither ethanol nor pseudo-opiates entering our bloodstreams during the review process, the only word we ended up with was 'Decent'.

Yes, C&C 3: Tiberium Wars is a decent game. Not wanting to rock the boat or even give the gunwales a slight push, EA Los Angeles

has stuck with the venerable formula that has unearthed success time and again. Admittedly the game does feature a new, third side – the Scrin – but even it is uncomfortably derivative. The singleplayer campaign is set in 2047, the planet almost entirely covered with a highly radioactive extraterrestrial substance known as Tiberium. Tiberium has continuously evolved since arriving on Earth over half a century ago, and its ability to transform anything it touches into more of itself has decimated both natural and man-made environments. While the Global Defense Initiative attempts to protect the few habitable areas left and develop a solution to the

Tiberium threat, safe in uncontaminated 'Blue' zones, the terrorist organisation known as the Brotherhood of Nod recruits disillusioned citizens in the Tiberium-crippled 'yellow' and 'red' zones, spreading its special blend of propaganda against the GDI and hailing Tiberium as a revolution. While humanity struggles to survive, somewhere in deep space an alien race called the Scrin awaits the completion of the final stages of its plan to colonise Earth – a plan it has patiently watched unfold for six decades.

This plot is further unveiled in the game's two available campaigns for GDI and Nod (a third shorter one for the Scrin is available as an unlockable), through the use of voiceovers in-game and live-action full motion video (FMV) between missions.

The poor quality of FMV from previous games in the series, in terms of both scripts and acting, has developed such notoriety that players now revel in its cheesiness like kittens in catnip. Long time fans will find themselves pleasantly shocked



It is easy for combat to become incredibly hectic



Many missions are carried out in the wastelands of the yellow and red zones.

Despite this Zerg-like scene, end-game Scrin tactics rely on a few tough units rather than masses of cheap, weaker troops.



to discover the EA has pulled out all the stops and filled the game with professional actors including *Lost's* Josh Holloway; Grace Park and Tricia Helfer from *Battlestar Galactica*; Michael Ironside; and Billy Dee Williams of Lando Calrissian fame. While the script still leaves something to be desired, the actors manage to transform what would normally be cringe-worthy dialogue into natural, and even inspirational, speech. To its credit, the plot does manage to cough up a number of nice twists, but holding your breath for these will result in asphyxiation before they do suspense.

As with previous C&C games, each mission is played out in a city or country on Earth. Once a mission is successfully completed you'll be awarded accolades depending on how well you did. The various theatres of war the missions take place in are never locked down, so you're free to go back and improve your performance.

Multiplayer gameplay sees each side modelled somewhat off those found in EA's C&C Generals – the GDI playing much like the USA, while Nod feels like a combination of China and

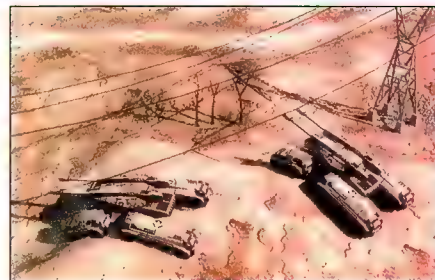
the GDA. The Scrin however blends the Zerg and the Protoss from Blizzard's RTS *Starcraft*, employing lots of cheap, weak troops early game and powerful battlecruisers and three-legged death machines late game.

Not that you'll make it to late game that often as despite all the work EA has put into the units, tank rushing is still the best strategy. In fact, its encouraged – while the game sports a basic 'tech tree', most of the upgrades do not affect each side's main tank unit or anti-aircraft infantry, so these units are just as powerful at the start of the game as they are an hour in.

Command & Conquer 3 is by far the best C&C game yet and has made some massive strides in its storytelling – the singleplayer is definitely worth the price of admission. If you enjoy the basic RTS gameplay of the series, then C&C 3 won't disappoint, but those after a more refined experience will find themselves staring longingly at *Warhammer 40K: Dawn of War* or *Supreme Commander* after being on the business end of their 100th tank rush.



The Scrin have no need for silos and as such, have the strongest economy



Developer EA Los Angeles
Publisher EA
Website www.commandandconquer.com
Recommended
2GHz CPU; 1.5GB RAM; 128MB
DirectX 9-compliant video card.

VERDICT

Runs well and looks good; new, additional side; GDI, Nod and Scrin campaigns; old school C&C gameplay.

Tank rush still the best strategy; average script; feels a bit simple.



SCORE
8.0
OUT OF 10



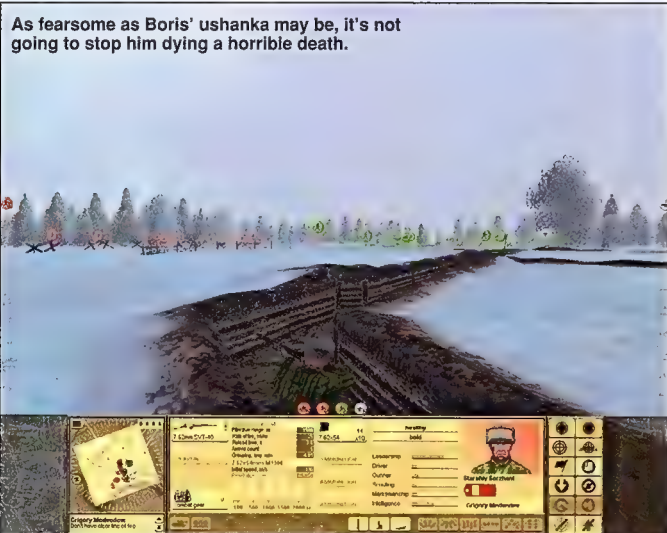
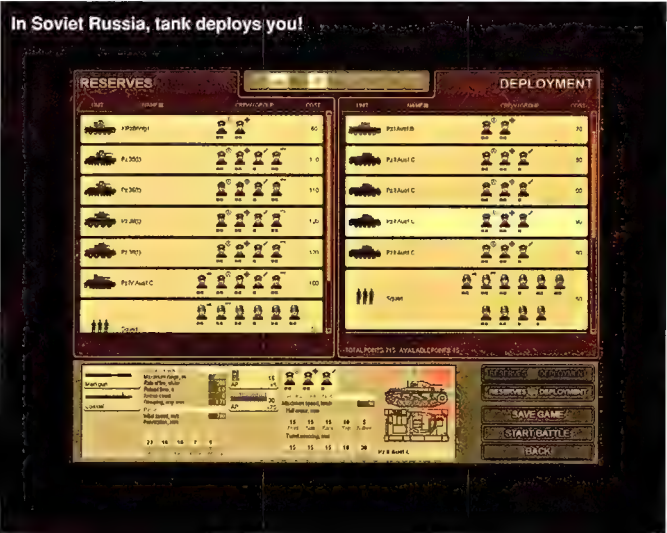
Theatre of War

David Kidd wonders what sort of performances he can expect on such a violent stage...

Theatre of War bears all the hallmarks of a classic before you even install it. First, it's developed by the guys behind the much acclaimed IL-2 Sturmovik; second, since being dumped by Codemasters, it's been under the watchful parentage of the gods of realistic strategy games, Battlefront. If neither of these names means anything, have no fear. All you need to know is that ToW is from a genealogically-sound stock, removing any doubt that this will be another half-baked WW2 RTS from Eastern Europe. This blind confidence comes largely from Battlefront's own WW2 series, Combat Mission, which can't be praised enough. It was strategic heaven – easy to play, realistic and designed like

no other strategy title before it. When Battlefront announced that the sequel, Combat Mission: Shock Force (see Scanner, page 11), would have a modern setting, many CM fans were disappointed. However, when Battlefront took on Theatre of War, with its polished graphics and respected development team, we knew we hadn't been abandoned. ToW is billed as a real-time strategy game, but that's just for convenience. This is a tactical game throughout, from deciding which combination of troops and armour you'll be taking into battle, to micromanaging your individual soldiers in the field. This is small scale stuff, featuring tight objectives in scripted

scenarios, rather than base building and capturing resource points. A key part of ToW is the RPG-like troop management, where every soldier has a set of skills from marksmanship to driving. The soldiers that survive at the end of a mission will receive experience points, which can be allocated to any skill and subsequently, improve that soldier's effectiveness in the next battle. On the field, you'll be watching closely how your troops are going, particularly the experienced ones, and ensuring they're being used effectively. This is not just a 'nice-to-have' element. One mission, for example, had us defending a hill from a rolling line of enemy tanks. We had two anti-tank guns, but the gun crews were wiped out before they'd finished off the tanks. With nothing else to stop the tanks, we flipped through our remaining soldiers, picked the ones with the highest gunnery skill, and sent them to man the guns. They weren't as good as the original crew, but they were good enough to finish the two tanks off, thus winning an otherwise impossible fight. This isn't a rare moment of



The big red arrows are made of win.



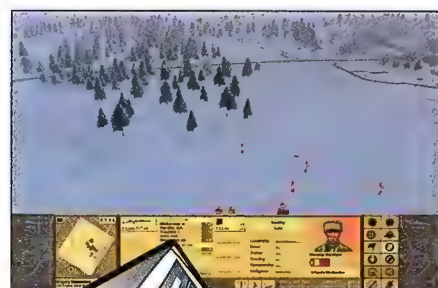
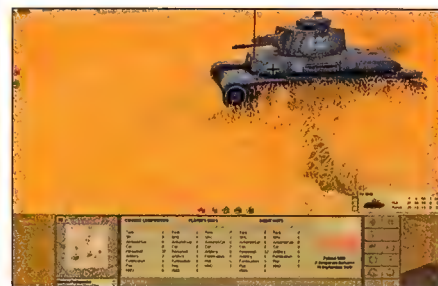
gameplay, either. Changing the roles of soldiers can happen many times in a battle, whether it's finding your next best marksman to pick up a sniper rifle, or rounding up an ad-hoc crew for an abandoned tank.

The interface is so simple that it shouldn't work as well as it does. A smart cursor tends to figure out exactly what you need to do, and rolling over units brings up vital stats like hull penetration – absolutely essential if you're wondering which side of a tank you need to hit to destroy it. Working hand-in-hand with the interface, however, is the AI. Each unit is smart enough to work out what to attack, based on their own effectiveness and the danger each threat poses, and so need little direction when it comes to combat.

There's certainly some vision in ToW, but it doesn't compensate for its lacking features.

Unless you're interested in vehicle detail (which is excellent), you'll be underwhelmed by the graphics and character animation. The content is lightweight – you'll only find a handful of standalone missions, and there's no instant action or random mission builder. Finally, standard RTS gameplay features we've come to expect aren't available (like having troops realistically garrisoning in buildings), making missions feel much 'lighter' than they should be.

In contrast to our opening statement, ToW actually is half-baked. It's fun, and it's one of the most realistic WW2 RTS titles out there, but it needed more development and polish. The touches of innovation like the granular RPG elements and natural AI are enough to satisfy, but don't expect another Combat Mission or Close Combat.



Developer **1C**
Publisher **Battlefront**
Website www.battlefront.com/products/tow

Recommended Windows XP/Vista;
2GHz dual-core CPU; 1GB RAM.

VERDICT

Technical detail, AI, hybrid RPG elements.



Dated graphics, few scenarios, feels incomplete.



SCORE
7.0
OUT OF 10

Even in something as strategy-heavy as Theatre of War, the tank rush is still the ultimate tactic.



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The Science of Sleep

CINEMA

Reviews: Rialto Entertainment. Web: <http://www.rialtomovie.com/scienceofsleep>
Director: Michel Gondry. Starring: Gael García Bernal, Charlotte Gainsbourg, Allen Choudhury

The Science of Sleep centres around the world of Stephane (Gael García Bernal, Babel, *The Motorcycle Diaries*) and his struggle with an invading dream state. The film is Michel Gondry's first solo feature film, after previously working with the help of a Charlie Kaufman script in *Eternal Sunshine of the Spotless Mind*.

Stephane returns to Paris due to the death of his Mexican father and moves back into his childhood bedroom in a small apartment. In his dreams he is the charismatic host of 'Stephane TV', where he teaches the art of dream cooking in front of cardboard cameras.

In reality Stephane has a dreary job at a calendar publisher, where he remains disillusioned by a lack of creativity and working in a cramped, strange environment. He shares his working day with two employees

obsessed with ski trips, and a vulgar older man who tries to offer the shy Stephane advice, but they prove to be two very separate personalities.

We then meet Stephanie (Charlotte Gainsbourg, *21 Grams*, *My Wife is an Actress*), Stephane's neighbour across the hall. At first Stephanie is charmed by his eccentric nature and their quirky love of art and craft seems to draw them together. However Stephanie quickly grows tired of Stephane's childish behaviour and flimsy grasp on reality.

When Stephane realises he cannot have her, he finds himself descending into a level of madness trying to seduce her. This only pushes Stephanie away and brings out a crude, deeply immature side of him. As she tires of his advances, we felt ourselves feeling the same way about his character and the movie as a whole.

Everything feels too whimsical and quirky. Surrealist films of this kind need to be supported by a solid script, and as Stephane was finding it hard to distinguish between his waking and dream state, so were we, and that didn't help a flimsy storyline that fell well short of the mark.

A cut-and-paste world of cardboard and cellophane is created by Gondry, but his grasp of film and the organic mechanics of it are quite something. It is obvious he is a firm believer in real effects and avoids CGI, something to be admired in this modern landscape of green screen cinema.

Gondry has admitted Stephane's story is autobiographical and drawn from his own experiences. We believe *The Science of Sleep* is autobiographical of him as a filmmaker: Still immature, shy and needs to be backed by a solid script. Nevertheless, we have faith this will come with time and believe his future films have great potential.  MD





The Intruders

BOOK

 Author: Michael Marshall
 Publisher: Harper Collins

While we've read most of his work, we're yet to decide if British author Michael Marshall is actually any good. His prose is always brilliant, but his plots tend to go haywire. Some of his novels – *Spares* and *One of Us* in particular, which were both penned under the name Michael Marshall Smith – get too weird to be enjoyable by about the halfway mark.

His latest release, *The Intruders*, is equally hard to award our seal of approval to. It falls vaguely – very vaguely, mind you – into the crime, thriller and horror genres. There are two main strands to the story – one a seemingly straightforward detective setup, the other something to do with a runaway girl – that initially seem to be completely unrelated. The first two-hundred pages or so of the book are very slow. The ending isn't as strong as it was clearly supposed to be and the twist is a little clichéd. *The Intruders* really could've done with a bit more work, maybe a few more months editing, rewriting and honing what had the potential to be a kick-arse tale. Unless you're a big Michael Marshall fan, don't bother with this one until the mass-market paperback hits later in the year. It's entertaining enough, but it's not the tight piece of storytelling we were hoping for after the lacklustre *Lonely Dead*. And definitely forget it if you've never read any of his work before. Look to the sci-fi flavoured *Only Forward* instead. **CT**

score **6.5**
OUT OF 10



Exiled

DVD

 Distributor: Madman Eastern Eye Director: Johnnie To
 Starring: Simon Yam, Francis Ng

Exiled is a strange film. You see, it's not only a Hong Kong action flick, but a western too. A western that's set in modern day Macau. It sounds like a potentially disastrous combination, but then, the idea of a sci-fi western didn't sound too good until Joss Whedon came out with *Firefly*, did it?

Exiled is about four gangsters who've just been given the rather grisly assignment of bumping off their former friend and colleague, Wo. Even though these men are professional killers, they're rather amicable sorts and agree to help their old mate do one final job. The idea being that his wife and newborn son will have some money to live on once he's gone. Of course, things rapidly turn pear-shaped and the hitmen find themselves joining Wo on his flight from the wrath of the Macau mob. The western motifs – the whiskey drinking, the shootouts, the scheming hooker, and of course, the idea of a band of revolver-toting outlaws with a thirst for justice – remain strong throughout and are combined beautifully with all the elements and nuances and of contemporary Hong Kong action films. As we said, *Exiled* is very weird, but it's thoroughly entertaining too. The action is sweet, the occasional moments of comedy are funny and the soundtrack fitting. Even if shoot-em'-up cinema normally leaves you dead and cold, be sure not to miss *Exiled*. We promise you won't be disappointed. **CT**

score **8.0**
OUT OF 10

ANIME OF THE MONTH

Your regular dose of anime goodness courtesy of our resident expert Armina Soemling.



Hellsing Ultimate V01

 Studio Satellight Distributor Madman Web www.madman.com.au Price \$29.95

Hellsing Ultimate opens with England overrun with vampires, ghouls and other supernatural forces of evil. In defiance of this stands the Hellsing Organisation, led by its hero Alucard ('Dracula' backwards) and his virgin-now-vampire sidekick Seras. But alas, attempting to thwart Hellsing's plans is Father Alexander Anderson, a bio-engineered vampire from the Vatican's murderous Iscariot Organisation.

So how good is the new *Hellsing OVA*? The animation is beautiful, the art style is edgier and the character designs ring much truer to the original manga. The newfound depth to the characters truly pulls at the heart strings as we watch the virgin ponder her fate as a vampire and wrestle with her old sense of humanity.

In short, *Hellsing Ultimate* is far better than the watered-down TV version. While some viewers may be repulsed by the endless sprays of blood, the misappropriation of religious symbols and the scenes of a virgin being sexually harassed, it was pure rapture for us.

score **9.5**
OUT OF 10

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GEEKETTE

A girl's eye
view of the
gaming world.

The little guy eats
kids? Really.. dear God.

It's a dog-eat-kid world

Kate Inabinet questions the lack of a virtual RSPCA.

Every time you play a computer game, a shelter kills a kitten. This is what Kersti Seksel, President of the Australian Veterinary Association, would have you believe.

According to some research conducted by Dr Seksel, a factor in the decline of pet ownership is children choosing PC and console games over pets.

'These days children interact more by playing computer games and less by going out there and throwing the ball to a dog. We need to learn people skills, physical skills and sitting in the lounge room with a computer doesn't teach you that,' she says.

For a start, I'm not entirely convinced that the constant repetition of 'Get the ball! Go on... get the ball Flossy. Good dog! Now bring it here. I said bri... Flossy! FLOSSY!' is teaching a child better people or communication skills than say... 'Right Cowtastrophe, I want you to run in and aggro that group over there, but don't get too close to the boss. If you can, try to draw them back one at a time. I'll heal you as long as you don't run too far out of range. The rest of you, just try to hit what the warrior is hitting or whatever starts attacking me and make sure you look behind you as you back up, we don't want to run into that patrol that passed us earlier.'

But also, as far as the physicality of a game of fetch is concerned, Dr Seksel has a point, albeit only until a Wii installment of Nintendogs comes onto the market and children can safely hurl a virtual stick at a virtual dog without the fear of being photographed by strange, trench-coated men hiding in bushes.

Playing computer games used to be a sedentary activity favoured by the unfit and unpopular, but today it's a different story, and a child can potentially get more exercise playing Wii Sports than they would waiting in line for their go at T-ball in school P.E.

I agree that playing computer games hardly replaces the joy of owning a pet, but try explaining to all the distraught kiddies who

dissolved into grief-fuelled catatonia when their Tamagotchi died, that it should instead have been a real live animal who perished slowly of starvation and neglect. Let's face it, as cute as a grimy little urchin cuddling a bunny rabbit is, pets at the hands of the young have a limited life expectancy. Children are fickle creatures by nature and they are hardly likely to maintain an interest in cleaning up poop when they struggle even to remain faithful to their favourite icy-pole flavour.

When adults get that crazy urge to settle down and rear multitudes of tiny carbon copies, it is not uncommon for them to adopt a puppy or a kitten first, in order to gauge whether they are responsible enough to be fit parents. Why then, would we discourage children from heeding the same example by allowing them to take care of a virtual pet before trusting an actual life into those tiny carnie hands?

There are few things more pitiful than the sight of an abandoned pet scrounging for scraps on the street. Their half-faded Christmas ribbons flapping forlornly against their toast-rack ribcages. Better a copy of Dalmatian and Friends be thrown onto the 'bored of' pile than little Mittens or Fido.

But really, if we are to be honest about it, children don't actually have the final say on whether they get a pet or not. It has nothing to do with choosing a game over a puppy, and more to do with parents saying 'No' to the mere idea of an animal companion. I'm willing to guess that particular scenario is more common than we think. The reduction of pet dogs probably has less to do with the creation of better and faster graphics cards and more to do with the fact that dogs continue to eat their owner's offspring.

Has your child, or a child you know, been consumed by a pet? Let Kate know.

geekette@atomicmpc.com.au



“If we're to be honest, children don't actually have the final say on whether they get a pet or not.”

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TECHNIQUE

HANDS-ON TUTORIALS FOR THE TECHNICALLY INCLINED

Painting a PC case may sound like a simple proposition – grab some paint, pull up a case and whack on a coat or two. It may come as a shock to learn that it's a little more complicated than this, especially if you want it to, you know, *look good*. We asked Ron Prouse for his advice, and he was kind enough to write a tutorial for us.

In the world of software, Leigh Dyer's been concerned for a while now that dual core wasn't pull its weight in the Linux world, and using his magic fingers, he put together a great little guide on optimising most flavours of the open source operating system for multi-core PCs. If you think you too might be missing out, hit up page 92 now.



TECHNIQUE CONTENTS

Case painting 101 88
Ron Prouse explains the ins and outs of painting your case. Now with an exciting practical example!

Dual core Linux 92
With processors regularly sporting two or more cores these days, Leigh Dyer felt it was about time to put the extras to good use.

Input Output 94
Dan Rutter does his Q&A thing again. Basically he helps people. We guess that makes him a helper.

Hotbox 96
Another tasty case mod to sink your teeth into... or just look at with your eyes.

Fallout 98
Logan Booker has an issue with Vista, now a rather common complaint.

Have an idea for an Atomic tutorial?

Then send an email to lbooker@atomicmpc.com.au

When it comes to tutorials, Atomic likes to tackle the hard stuff. If it's not hard enough, we just don't do it. Alright – that's not necessarily true, because every once in a while, we like to cover the easy tutorials too. Not so much easy as basic, you know... building the skills, the foundations you need so you can have a go at those tricky tutorials.

We know that techniques change, as does technology, and guides that might have been useful a few years ago can be close to useless today. So, if you have an idea for a basic tutorial, like soldering, water-cooling or harpooning whales even, let us know.

Now go email!





DIFFICULTY INTERMEDIATE ●●●●●

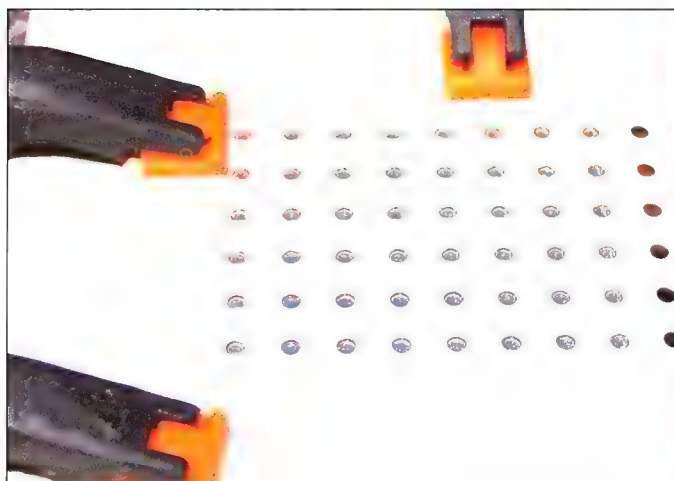
Practical case painting

Ron Prouse provides his expert tips on coating your case in liquid fun.

The subject of this month's tutorial was introduced simply enough, 'How about putting together a couple of pages on case painting?'

Rather than try to cover a heap of ground that may not be of relevance to most readers, we've put together a work log on a common case painting scenario with methods that can be applied to other projects. The application we decided to run with is one of our pet hates – ventilation perforations. Those ugly blocks of 3 or 4mm holes along side panels that are supposed to aid the flow of cool air, but are really just an easy way for dust to enter – and noise to exit – the case. To make the 'before' and 'after' steps more obvious, we've only covered in a 65 x 45mm section, leaving the remainder as the 'control'.

The first step was to glue a piece of aluminium sheet behind the holes, using a thin, even coat of five-minute epoxy resin. The plate was then clamped into place until the glue had fully set. For this exercise we had 48 holes in the side-cover that needed to be filled, undercoated and painted, however they could have just as easily been any type of surface imperfection.



SUPPLIES

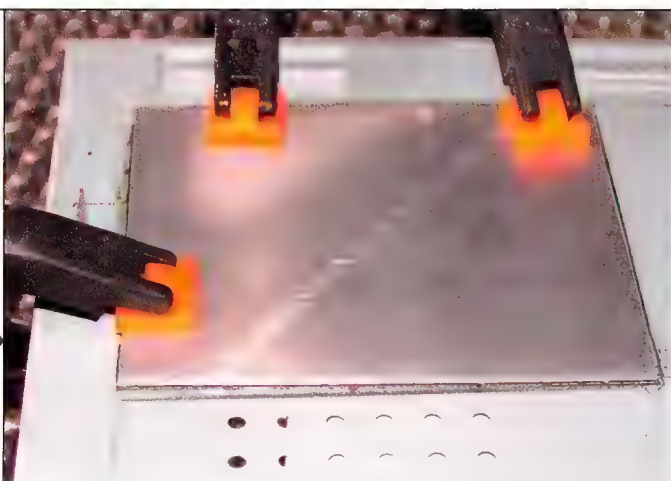
Most of the requirements for this tutorial can be purchased at hardware stores and model supply shops.

TOOLBOX

The tools used in this tutorial are mainly those found in the average garden shed, including epoxy glue, body filler, sandpaper, and aerosol paint finishes. The main requirement is a decent bench or table, providing a solid, flat surface to operate on.

1 The supplies needed for this step are body filler, spray putty, a good undercoat, a 10 x 8cm cork sanding block and reams of Wet'n'Dry sandpaper in varying grades. The reasons for painting are many, but the desired outcome is the same – to create a smooth and blemish-free surface. Regardless of the starting point, the only way to achieve the perfect finish is to put time and effort into the initial preparation. Don't be fooled into thinking that the final coat of paint will cover the imperfections – in fact, it will usually accentuate them.

Concentrate on one panel at a time and start off by marking any dents or damaged areas that need repair. Remove any flaking paint and 'rough-up' the surface with 400-grit sandpaper. This is also a good opportunity to de-burr the case, removing any rough edges and rounding off sharp corners. Major chips, deep scratches and repatriating around modifications are best filled first with a two-pack polyester resin (body filler).





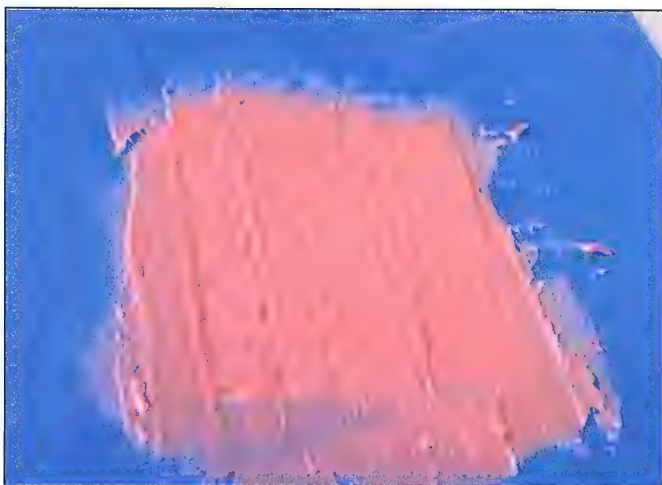
To 'sand out' chips and scratches means removing all of the surrounding paint, down to the depth of the imperfection, and that often means abrasion right back to bare metal for the whole panel. If there are dents in the panels then they will still remain even after sanding.

Small imperfections can be removed later with a high-build spray putty, performing the same function as the body filler, but on a micro level. The spray putty will also give a good indication of the look of the final surface, as it goes on like a thick undercoat.

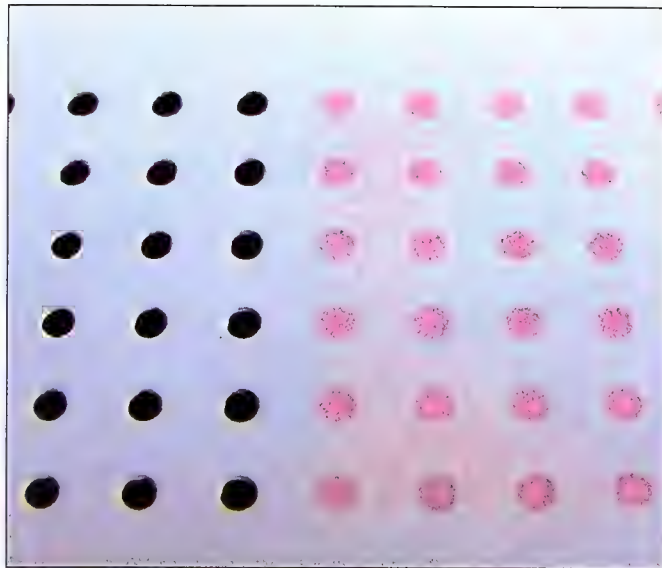
2 After taping off the area well outside of the perimeter being filled to allow for blending or feathering of the edges of the filler, the two-pack polyester resin is mixed at a defined ratio with hardener, making sure to follow the mixing and safety directions. In a perfect mix, the resin is soft and pliable, and has the consistency of warm plasticine – avoid the use of excessive hardener as it will make the resin set too fast.

Using a sharp spatula, the resin is pushed into the holes so that all of the air is expelled; once all of the holes are filled the surface can be smoothed off with a paint scraper. In areas where the body filler has to be used fairly deeply, best results will be achieved by applying several successive layers (after allowing each layer to cure) rather than using just one thick layer. Thick layers are more likely to result in air bubbles or cracks, and therefore create more work.

Once the body filler is dry, the masking tape is removed, and the surface wet-sanded down to level using a cork sanding block (block rubbing or 'blocking') and 600-grit Wet'n'Dry.

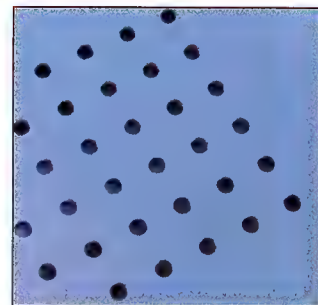


3 After sanding down to the finished level, you may find that there are cavities that have been created by air bubbles that were trapped in the holes or gaps. After drying the work-piece thoroughly and wiping over with wax remover, one remedy is to repeat the previous step until the surface is uniformly smooth and even. Another answer, especially for small pinholes, is to use a product called spot putty. Spot putty in essence is a premixed body filler of thinner consistency. Again, thin layers are better than big blobs. As you can see to the right in the image below, there shouldn't be any residual body filler above the level of the holes, or on the surface of the panel.



4 Spray putty will fill in any small scratches and blemishes on the prepared surface, and applies like a thick undercoat. To get an absolutely perfect final finish, such as the mirror finish on show cars, can take as many as 30 individual coats of filler, with each coat almost completely sanded off before the next is applied. Sanding back panels should only be done with 800-grit Wet'n'Dry, plenty of water and a sanding block.

Spray putty can initially be applied in spot areas and then once all of the problem areas are looking as you want them, the whole panel can be sprayed and sanded back with 800-grit Wet'n'Dry.



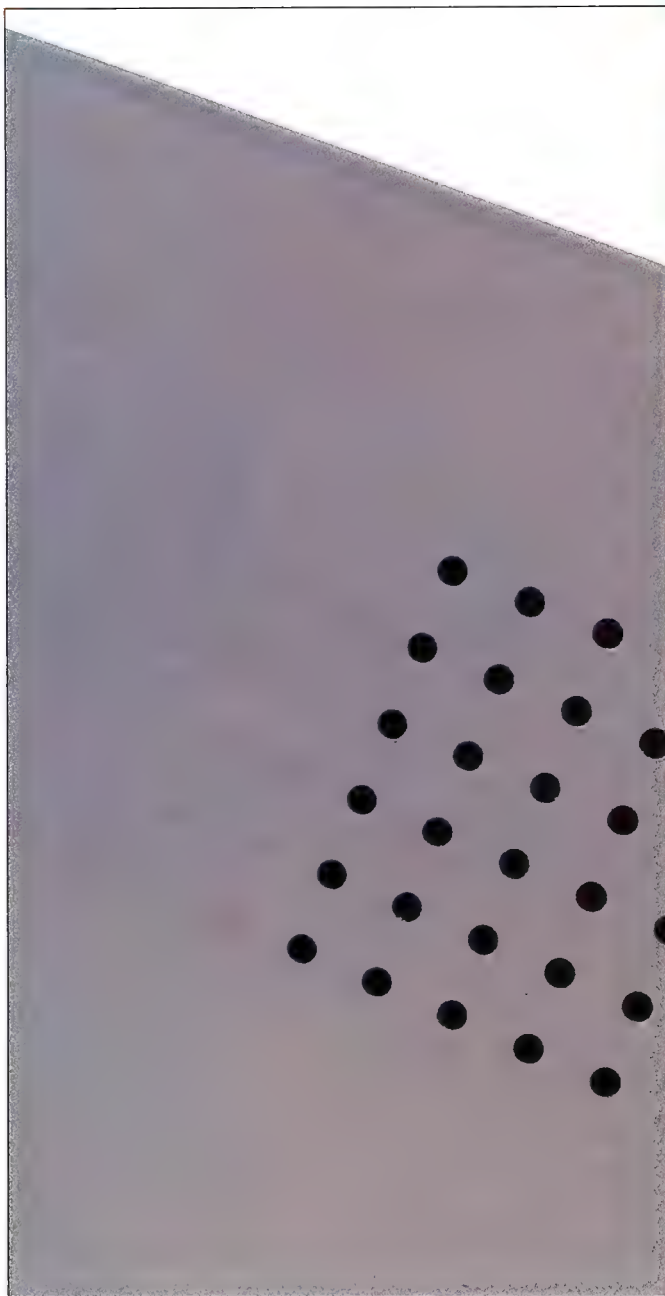
5 Undercoats, or etch coats, are important from several standpoints, and the word of the day here is 'Consistency'.

Firstly, body filler and spray putty are porous, which means that they will absorb paint at a different rate to the metal or pre-painted areas of the panel. They also have a tendency to dry to a matt or semi-gloss finish. Undercoats seal these compounds and provide surface consistency.

Undercoats are also important as they lock the paint to the surface below. Imagine it like a chemical version of Velcro. Most etches especially work in this way, eroding or melting the surface underneath to create that bond as they cure (or dry). The result is a consistency in adhesion.

The third important attribute of an undercoat is to give the object a consistency of colour. The image below shows the side cover after one light dust coat of etch, and it is still easy to see the holes and spray filler – it might take several coats of a light-coloured paint to cover it up satisfactorily. An undercoat will give an even-coloured canvas to apply the final coats over.

Each application of undercoat should be allowed to dry and then gently sanded back with 800-grit Wet'n'Dry.



6 When it comes to the actual process of painting there are quite a few options available, depending on the amount of cash you want to spend and the finish you're looking for. The best results will be from using automotive finishes sprayed at high pressure in a hermetically-sealed room, and then dried under heat-lights. Not that practical for most home handypersons! Of course, it is possible to take your primed and primed case to a professional spray painter for the final squirt, and if you are not fussy as to the colour they might even offer to 'blow some colour over it next time we are painting a (insert colour choice!) car', usually at a very reasonable cost.

In the case of most DIY projects, the next best answer is to use automotive touch-up paints, which are widely available in a multitude of colours and relatively inexpensive in small quantities. One of our favourites is the Holts Dupli-Color range of 'mixed for you' aerosols, allowing you to choose colours that may not be available commercially.



7 Choosing a place to paint is a very crucial point. An obvious OH&S issue is the build up of toxic fumes, however, it is also important to be aware of dust, bugs and passing traffic. The longer the painted panel can be left to dry in a pristine environment, the better. Conversely, the more chance of foreign bodies coming into contact with it quickly diminishes the chance of a great outcome. Also remember that the first thing that most people want to do with wet paint is check if it's dry.

If you are spraying in an area where over-spray could cause damage, the use of dropsheets and backdrops might save you grief later on.

Before you start to paint your project, practice on something unimportant that has a similar finish. Every paint applies slightly differently, while ambient temperature can have a huge impact, as can humidity. Get a feel for the spray nozzle, optimum spraying distance and, well, the 'vibe'.

The last step before applying the first layer of paint is something that you should do between each and every coat – wipe over the panel with wax and grease remover, allow it to air dry, and then blow off any residual dust, lint or fluff, as anything left on the surface is about to be stuck there for good.

The colour that we have used here is a Glasurit Indischrot (Porsche Guards Red), as it is a high quality product that is easy to use. As an aside, the Glasurit website has some fantastic fault-finding guides for home painters (www.glasurit.com/Service/AdviceOnPaintDefects) and covers nearly all common painting problems and their remedies.

The first colour coat is important, as it is the best opportunity to make sure that you get proper coverage in all of the nooks and crannies – in this example, inside the edges of all of the remaining ventilation holes.

Spray on the panel in uninterrupted, even strokes that overlap the previous one. Each stroke should start and finish a few centimetres outside the perimeter of the edges. Don't be afraid to turn the panel and spray it from different angles, as this will aid you to ensure full coverage.

Paint should be applied in light, even coats, and it's important the surface stays wet as you spray, especially the areas where there is overlap of your strokes. Where possible, avoid runs and orange peel, but don't panic if this first coat is less than perfect – there is plenty of opportunity to fix it and spray again to get that extra coat and two repetitions of this step.

8

Wet sanding between coats with 1200-grit Wet'n'Dry will remove the build-up of orange peel (the insert in the below image) and unevenness of the paint, and provide the next coat with something to grip to. Just make sure to allow plenty of drying time before you start as sanding semi-wet paint will create an enormous mess! Don't get too carried away with sanding (unless you have a major calamity to repair) in case you rub right through the paint on the edges or grooves of the panel – in fact, a fairly gentle, even rub-over should result in a smooth surface to continue on with. The main area of the picture should give some indication of what you are trying to achieve – an even amount of slight scuffing on a smooth background.

One rule that many people don't follow is to wet sand the final colour coat if you are going to apply a layer of clear. Yes, it seems sacrilegious, but it really needs to be done regardless of how good it looks so far! Note that a clear coat is not an absolute necessity, so don't feel bad if you decide to finish off with the colour instead. That's what we did!

9

The final coat is always the best coat. Whether it is a colour or a clear coat, this is the one that really matters, and where all of the surface preparation pays off. The aim is to get a smooth even finish, with the least amount of orange peel possible. How do you avoid orange peel? When spraying with an aerosol can it is usually caused by one or a combination of the following:

- Spray can held too far from the surface (however remember that too close will cause runs);
- Poor atomisation of paint (check and clean the spray nozzle, especially if it is spluttering blobs of paint);
- Spray pressure too low (buy another can, you cheapskate!);
- Paint being applied too thinly or thickly.

A mild amount of orange peel is relatively easy to remove by gently wet sanding with a well-used sheet of 1200-grit (so that it is more like P2000), and then polishing out the residual scratches with a cutting compound such as Glasurit Fine Polishing Paste. This takes time and elbow grease to achieve if being done by hand – as opposed to using an electric buff – however the result should be an almost piano-gloss finish with a rich depth of colour.

The final step is to finish off with a deep gloss polish, such as Meguiars Gold Class Liquid Car Wax, and a soft cloth to buff the new paint to maximum shine. Just a word of warning – as well as looking stunning, your case will now be one slippery little sucker so pick it up with care! 



File Edit View Terminal Tabs Help

```

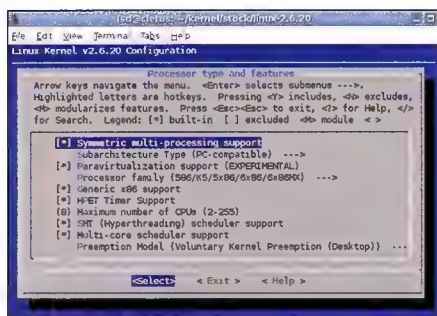
success: format: 0 data: 0x0 - 0xae9a800
AVI file format detected.
VIDEO: [XVID] 640x480 12bpp 29.970 fps 997.7 kbps (121.8 kbyte/s)
[V] filefmt:3 fourcc:0x44495658 size:640x480 fps:29.97 ftime:=0.0334
Opening video filter: [expand osd=1]
Expand: [x] [1] [0] [0] [0] [0] aspect: 0.000000, round: 1
Opening video decoder: [ffv1] [0] [0] [0] [0] [0] avcodec corec family
Selected video codec: [ffv1] vfm: ffmpeg (FFmpeg MPEG-4)
=====
Leigh Dyer wants to put his lazy cores to work. So should you!
=====

```

DIFFICULTY INTERMEDIATE

Dual core CPUs may be fairly new, but as dual core systems are little different to systems with multiple physical CPUs, OSes such as OpenBSD, UNIX and Linux have great support for them.

To get all of your cores working, you need to enable Symmetric Multi-Processing (SMP) support in the Linux kernel. Some distributions, such as recent versions of Ubuntu, use SMP-enabled kernels by default. Others, like Fedora, choose between SMP and non-SMP kernels at installation based on your hardware, so if you're upgrading an existing system to multi-core you may need to manually install the SMP kernel.



▲ Make sure you enable SMP support when building kernels from scratch.

For Gentoo users (and anyone else that doesn't think it counts as a kernel unless you built it yourself), the SMP options are under the 'Processor type and features' menu in the kernel configuration. Enable the 'Symmetric multi-processing support' option, and if you're building a complete monster, increase the 'Maximum number of CPUs' option from its default of one. You also need to enable 'Enhanced Real Time Clock Support', under Device Drivers/Character devices, and it's a good idea to enable ACPI if you haven't, because that enables the Power Management Timer, a stable system clock source that works around timing issues in many dual-core chips.

With all the right bits in place, the easiest way to check if all your cores are available is with an old-fashioned 'cat /proc/cpu' command. With any luck, you'll see an entry for each CPU core in the system.

Getting to the fun stuff

One of the best demonstrations of Linux's multi-threaded prowess is pbzip2 (compression.ca/pbzip2), a multi-threaded version of the popular bzip2 compression tool. Most distributions now include packages for it, but failing that you can grab the source code from the website.

Assuming you have a big file ready to compress, using pbzip2 couldn't be simpler:

```
pbzip2 -kv linux-2.6.20.tar
```

Well, it would be simpler without the '-kv' bit, but the 'v' flag enables progress reporting, and the 'k' flag disables deletion of the source file.

pbzip2 automatically detects the number of CPU cores on offer and uses them all, and it scales almost linearly too, so on a dual core system your compression times basically drop by half.

The only problem with pbzip2 is that it can't pipe data, so running the output of 'tar' through it and ending up with a super-speedy .tar.bz2 file isn't possible. For that, there's another parallel bzip2 tool called bzip2smp (bzip2smp.sourceforge.net), which works only for piping. Download the tarball from the website, extract it, and run 'make' to build the bzip2smp binary, which you can then manually install:

```

tar xzvf
bzip2smp-1.0.tar.gz
cd bzip2smp-1.0
make
sudo cp bzip2smp /usr/local/bin

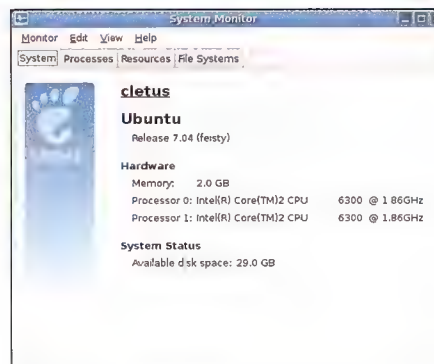
```

Making a tarball in one pass with tar and bzip2smp isn't too tricky:

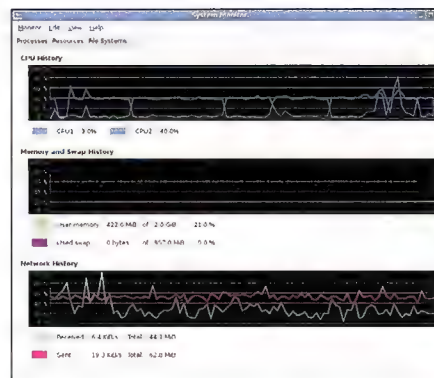
```
tar cf - files | bzip2smp >files.tar.bz2
```

Unfortunately, as both bzip2smp and pbzip2 only do half the job each of the regular bzip2, neither is usable as a drop-in replacement for it yet. Hopefully one of them will soon come up to scratch and we'll be able to forget that bzip2 was ever single-threaded.

If you like to compile software, whether it's just the occasional program, your kernel or your entire system (for Gentoo users), you'll be glad to know that this is easy to make multi-threaded. The 'make' tool has a flag, '-j',

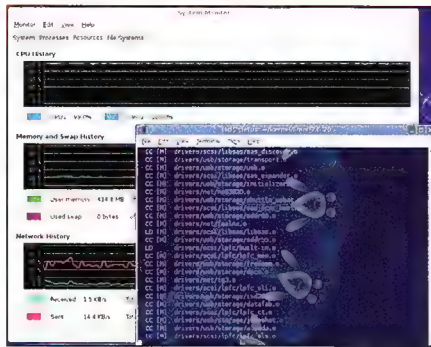


▲ Success! System Monitor shows two CPUs.



▲ System Monitor plots each CPU core on its usage graph.

which lets you specify the number of jobs to run simultaneously. Some makefiles don't get much benefit from this, and some others actually break when you use `-j`, but for most large projects, and especially the kernel, it works wonders. You specify the number of jobs to run after the '`-j`', like this:



▲ Kernel builds fly with 'make -j3'.

make -j3

Three jobs at once is a good option for dual core systems – having more jobs than cores means that if one job is stuck waiting for IO, there's another job there that can run in the meantime. As long as you have the RAM to run everything, you can try pushing the job number higher, but the gains will be very small.

Video encoding

A few months ago we looked at encoding video under Linux, including x264, an open source H.264 (MPEG-4 AVC) codec. Since then, x264 has gained impressive multi-threading support, which can boost performance by up to 90 percent on a dual core system. These new features haven't seen an official release yet though, so you'll have to build an x264 snapshot, and a copy of MEncoder using it, from scratch:

- 1) Go to the x264 site (www.videolan.org/developers/x264.html) and grab the latest 'daily tarball' file.
- 2) Visit the MPlayer site (www.mplayerhq.hu) and grab the latest source code release.
- 3) Extract, configure, build, and install x264:

```
tar jxvf x264-snapshot-20070406-2245.tar.bz2
cd x264-snapshot-20070406-2245
./configure --enable-shared --enable-pthread
make -j3
sudo make install
```

- 4) Extract, configure, build and install MPlayer – this will install MEncoder as well. After the 'configure' stage, make sure 'x264' is shown in the list of enabled codecs:

```
tar jxvf MPlayer-1.0rc1.tar.bz2
cd MPlayer-1.0rc1
```

SCALING

A word often used in multi-core circles is 'scaling', and in this context it describes how much benefit an application gains from adding an extra CPU core, usually expressed as a percentage. For instance, an application with 100 percent scalability across two cores would be twice as fast as the same app on one core. However, 100 percent (or 'linear') scaling is virtually impossible to achieve, because even with algorithms that can be made to run in parallel there is overhead involved in managing the various threads and handling any cross-communication. System limitations, such as shared memory bandwidth, can also limit scalability. Many tasks do have near-linear scaling though – pbzip2 is a great example.

```
./configure
make -j3
sudo make
install
```

You can now use MEncoder as you would before for H.264 encoding. To enable multi-threaded operation, add 'threads=auto' to the '-x264encopts' section, like this:

```
mencoder
input.mpg
-ovc x264
-oac copy -
x264encopts
bitrate=800:
threads=auto
-o output.avi
```

Use these commands for a high-quality, two-pass encode:

```
mencoder
input.mpg -
ovc x264 -oac copy -x264encopts
subq=5:8x8dct:frameref=2:bframes=3:b_pyramid:
weight_b:threads=auto:pass=1:turbo -o /dev/null
mencoder input.mpg -ovc x264 -oac copy -
x264encopts
bitrate=800:subq=5:8x8dct:
frameref=2:bframes=3:b_pyramid:weight_b:
threads=auto:pass=2 -o output.avi
```

The video encoding tutorial used very similar commands – we've just added the 'threads=auto' option, as well as the 'turbo' option of the first pass, which speeds things up with very little drop in quality in the final pass. Enabling multi-threading itself causes a drop in quality, but it's far too small to notice.

Fun and frivolity

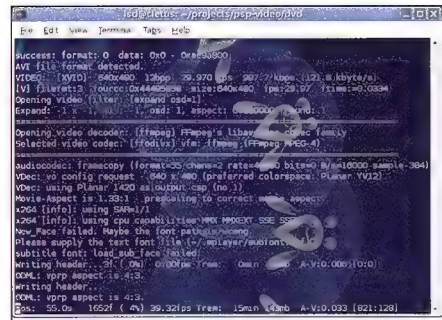
Getting the most of a dual core system doesn't always mean multi-threaded apps: sometimes it's just a matter of throwing an app on to that spare core that you wouldn't run otherwise. Dual core makes running a Windows system under QEMU (qemu.org) much more practical, as you'll still have plenty of power on tap even if Windows is running at full speed. Software RAID can also use a bit of CPU power, but isn't an issue on dual core.

A great frivolous use of CPU power is an audio player called Aqualung (aqualung.sf.net).

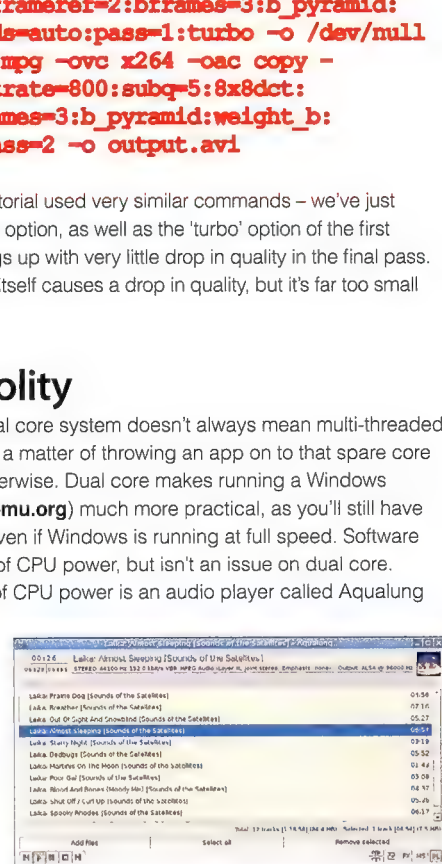
With an appropriate HD audio card, it can use some very powerful algorithms to resample all your music in 24-bits at 96kHz, eating a good 30 percent or so of a CPU core in the process.

Now, put those cores to work!

CORES	TIME(seconds)	SCALING
pbzip2 2GB file compression		
1	702.6	99.0%
2	336.9	
bzip2smp/tar compression		
1	162.8	93.0%
2	84.3	
Linux kernel build		
1	1787.8	87.8%
2	951.9	
x264 encoding		
1	2578.3	80.9%
2	1424.9	



▲ H.264 encoding at faster than real-time: Hell yes!



▲ Waste some CPU cycles with Aqualung's high-quality resampling.

Issues of the tech kind

If you send a problem to Daniel Rutter at io@atomicmpc.com.au, he may very well find a solution. Or not.

Fixing stuff no one else can, including God and your mum



He also glows in the dark

 A mate of mine who I've known for quite some time only recently informed me that he was 'booted' by a CRT picture tube some years ago. Today, whenever he touches a floppy disk (and a lot of other electronic components) he kills it instantly. We tested this time and time again.

To be absolutely certain, I stuffed around 1MB of data onto five brand new floppies and laid them out on a wooden table. He proceeded to pick them up and then place them back down. I quickly threw them in the drive, and four were unreadable. The disk that survived only worked twice.

We used two different floppy drives for proper testing.

Could you please give us some advice? Every time he comes over he destroys something in my room. Only last week I had purchased a brand new Sapphire Radeon X1650 Pro. He touched it. I installed it. All I saw were green vertical lines.

Josh Wood

you report is, clearly, paranormal.

The Australian Skeptics have a \$100,000 prize (tinyurl.com/2MES9P) for anybody who can demonstrate a paranormal ability – and there's a \$20,000 spotter's fee for anybody who merely *nominates* someone who later wins

the prize!

That's small potatoes compared with James Randi's Million Dollar Challenge (tinyurl.com/2CAoS), though, which will pay out a cool *million* US bucks.

I've a passing acquaintance with Barry Williams, President of the Oz Skeptics, and I've swapped mail with Randi as well. So I'll be happy to help you out if you have problems with your application.

It would, of course, be churlish of me to point out that it's quite easy to barbecue a video card just by touching it if you don't take proper anti-

static precautions. It's also very easy to wipe floppy disks by using elementary conjuring techniques and small rare earth magnet.

Your friend, of course, certainly is not having a bit of a lend of you by doing any such underhanded things. He will therefore pass with flying colours the tests which have, in the past, invariably been failed by other people who claim to be 'magnetic', or able to damage any electronic item that comes near them, and so on.

Get ready to cash in!

I/OOTM wins a Logitech G5!

Look at it? Isn't it beautiful? All you have to do is impress Dan and it can be yours.



Step 1: Get new son

 My son dropped his Nintendo DS in the toilet. I went to pull the cover off so as to give it a chance to dry out while I crossed my fingers, but noticed that some of the Phillips heads were not really Phillips heads. They are small screws that look like a "Y" and I dare not try to open them lest I mangle them.

So what is the best way, short of removing the cover, that this could be given a chance to dry out? A sunny window ledge? How long before I know if it's cactus or not?

Russell Stapleton

 The funny screws are the 'tri wing' type. Drivers to suit are easy to find on eBay. Not that that helps you right now, of course.

Put the wet DS somewhere warm and breezy. An adjustable lamp with a 100W bulb in it pointed at the item in question from a suitable distance, plus a desk fan blowing over it, will give you your best chance. Remove the battery and the GBA-slot cover, obviously. Turn the DS over a couple of times while it dries.

There's no harm in leaving such a setup going for a day or more, but there shouldn't be any water left, even in nooks and crannies, after 12 hours or so with the thing at 70-odd degrees.

You can displace water from electronics by dunking the device in alcohol – plain meths is OK. The alcohol then evaporates much faster than water would, but it can, itself, damage things that water wouldn't have.

Tap water is not very dangerous to most electronics, but that does indeed depend on how long the water's left there. The game port contacts and the LCD hardware would be the most susceptible to damage, I think.

[illegible]

They never mentioned the side effects!

 Fortunately, your friend's difficulties with technology are entirely outweighed by the fact that he is worth at least a million US dollars.

There is, you see, no way for a human being to be permanently charged with electricity or made magnetic – at least, not according to well-accepted basic physics, anyway. So the ability

I/O OF THE MONTH

And could we put it on a frickin' shark's head?

I A friend of mine and I are working on a project to 'disrupt' a satellite in orbit. Using 30-plus microwave magnetrons, hundreds of capacitors, 12V batteries, an old trailer (for the housing) and a custom-designed PC board, we would like to concentrate that energy and tunnel it towards our target, a satellite. Preferably a Foxtel sat that is used to send video imagery to hundreds of thousands of homes across Australia.

My question is, in your opinion, what would be the margin of failure, if we have the correct coordinates and enough microwave energy, to successfully disrupt and perhaps damage a satellite?

We have already built a smaller, more compact unit that is capable of destroying motherboards, ICs etc. We originally intended to use this 'brain boiler' to raise the temperature of people's brains to the point of collapse, but haven't exactly had the right situation to test it

Brain Boiler

O The very lowest of low earth orbits is about 200 kilometres up. If your beam diverges by only half a degree – and I assure you that it'll actually be much worse than that – then it will illuminate an area 1.7 kilometres in diameter at a distance of 200 kilometres.

This will reduce the power per unit area of the beam by a factor of several million, compared with the power it has if you just shoot your friend on the other side of the room with it.

If you have fifty synchronised magnetrons aimed at that 200km-away target, each emitting a thousand watts, you'll be illuminating that target with around 20 milliwatts of energy per square metre (ignoring atmospheric losses, which will be considerable if there are any clouds). That energy level is easy enough to *detect*, but no good if you want to fry something.

And very few satellites are that low. The International Space Station is about 360 kilometres up, and still needs regular re-boots to compensate for drag from the outskirts of the atmosphere.

If you're interested in shooting at TV satellites, your situation will be far, *far* worse.

Satellites that sit still in the sky so that fixed antennas can always see them are, by definition, in geostationary orbit. That means they're orbiting above the equator, and so far up that the orbital period of the satellite is the same as the rotational period of the earth. The orbital period of the International Space Station is only about 92 minutes. You need to go a lot higher to get a period of 24 hours.

A satellite in such an orbit, like the Optus C1 that you hope to attack, will be about 35,786 kilometres above sea level. Add a bit if you're not shooting from directly under it (in the middle of the ocean, 1300km north-east of New Guinea).

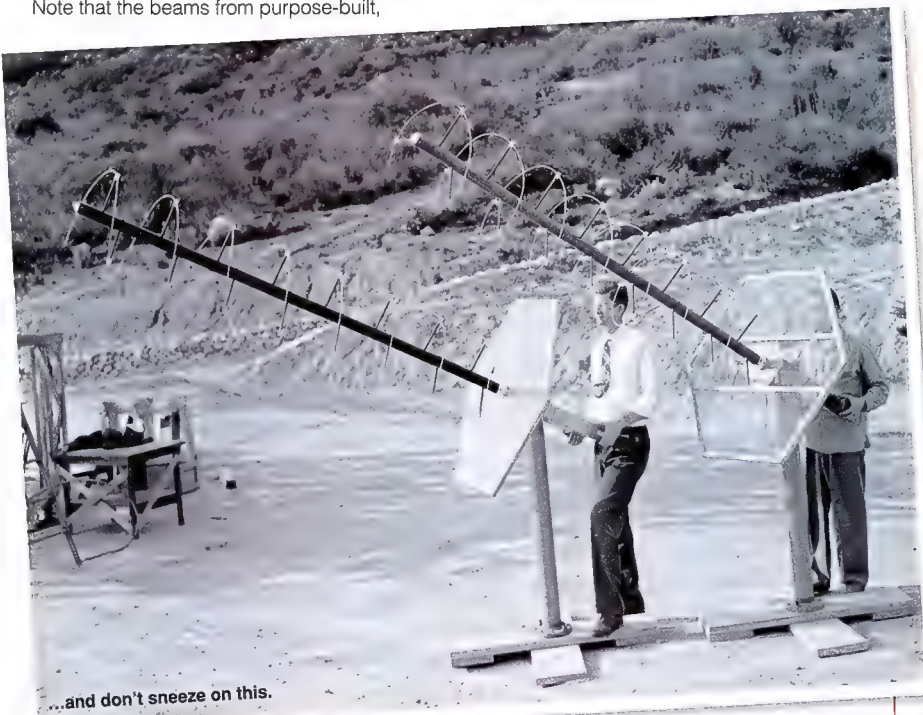
Now, even if your beam divergence is an extremely unlikely 0.1 degrees, you'll be illuminating an area some 62 kilometres in diameter. The satellite would therefore need an antenna many times larger than it is to collect enough energy from your beam to dimly light one small LED.

Note that the beams from purpose-built,

finely-tuned and very large satellite uplink antennas are still wide enough that satellites have to be separated by at least a degree or two. Your beam won't be that good.

Home-made microwave weapons, usually referred to as High Energy Radio Frequency or HERF guns, are extremely dangerous to be near but quite easy to make. One of the several reasons why we see few to no electromagnetic beam weapons on the world's battlefields, though, is because it is so much easier to deliver energy to a target by hurling a chunk of metal at it than by trying to focus a beam tightly enough that it can still achieve something when it gets there.

It is, of course, *not* easy to hurl metal at a target 36,000 kilometres away, which is why anti-satellite weapons are so difficult to make. If you could shoot even civilian satellites down with a HERF gun, even if you needed a nuclear power plant to run the thing, then people would have been doing it since about 20 minutes after the launch of Sputnik.



OSes within OSes

I I am, like many other people, having trouble with running all my favourite games on Vista.

After a while, I stumbled on a page that talks about running two operating systems at the same time on the same desktop. The software is made by VMware.

Would running XP on Vista via this software cure Vista's compatibility issues?

Tuck

O There are many interesting things you can do with 'virtualisation' software, but this isn't one of them.

To cut to the chase, what you want to do is dual-boot Vista and XP – by installing XP on your Vista computer and telling it to *not* 'upgrade' Vista, then crossing your fingers and throwing salt over your shoulder. You don't want to run one OS within the other.

If nothing else, the performance penalty of virtualisation is likely to make a lot of games unpleasant to play on a virtual machine (VM), if

they can run at all. 3D support is, for instance, flaky to non-existent in virtualisation packages.

Price, though, is not a problem. VMware Player (which can run VMs but not create them) and VMware Server (which can create them) are both free downloads as is Microsoft's Virtual PC package for Windows.

Note that the Vista Home license agreement forbids running the OS on a VM. It'll work fine, but Microsoft wants you to pay more if you intend to do that. Nobody's entirely sure why, beyond the fact that Microsoft likes money.



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Robert's Coffin Case

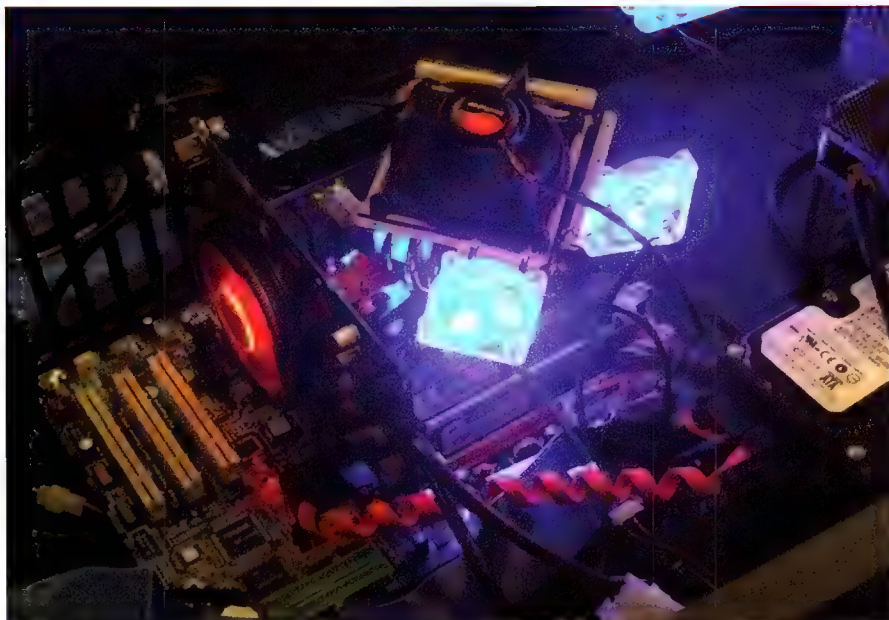
It all started when my girlfriend brought me a new computer about a year ago. I choose to go with a Thermaltake Armor case, which came with some pretty bling bits and pieces. For my birthday this year I got the Zalman Fatal1ty GPU cooler, Mini Typhoon value pack CPU cooler and Extreme Spirit 2 northbridge cooler. After putting all this into the Armor, things were looking good but I wanted to show it off more. I wanted to build something original so my girl said: 'Why not a coffin?'

I got to work pretty much straight away.

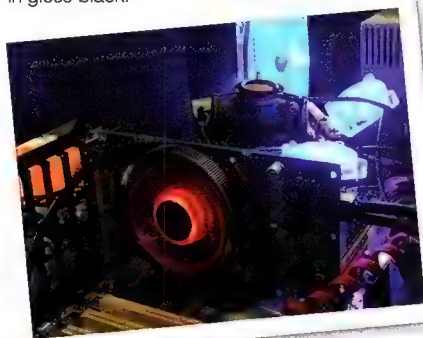
I hacked an old case to bits using the CD-ROM, HDD, mainboard and PSU framework to mount the parts from my case. From there it was onto designing and constructing the box. I didn't really encounter any problems during this stage at all. To be honest there was not a lot of science involved, just putting things where I wanted them to go and marking out the shape of the coffin. I already had the plywood for the lid and base, but not the sides, so it was off to the hardware shop. It

Fame, fortune and free stuff can be yours! Send your Hotbox to hotbox@atomicmpc.com.au and make sure you include the following details so you can be eligible:

- ▶ 6-12 high resolution, well-lit pictures of the inside and outside of your case
- ▶ A 500-word description of how you made it, the obstacles you overcame, the tools you used, and your inspiration
- ▶ A detailed list of the machine's specs. Include CPU, video card and RAM



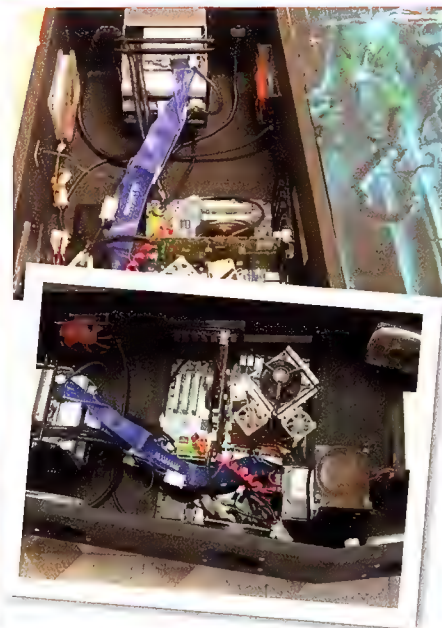
was simple after that. I just cut all the parts and put them all together. Cutting out the holes for the fans was the most time consuming part because I only have a jigsaw, so I took my time to make sure I was cutting a neat circle. Once it was all together I gave it a really good sanding then painted the box with some matt-black paint that I already had, and spray-painted the parts I cut from the old case in gloss-black.



After putting the comp back together I found that I had to do some creative wiring to get power to everything. For example, I had to extend the power cable to the CD-ROM and floppy by cutting a power cable from an old PSU and splicing it onto the power cable from the Thermaltake PSU. Once I had done everything the beast was alive.

Lucky for me there was not all that much cost involved – \$25 for the timber, \$8 for a can of spray paint and \$50 for two Thermaltake fans. I could not resist the Thermaltake iFlash – what a cool fan!

The case has five 12cm fans all round, three on one side pulling air in and two on the other taking the hot air out. I put a 9cm fan above the HDD to circulate some air around it. The other cost I suppose was the cooling devices – all up they were about \$160. The Zalman is amazing, it cuts temps in half even under load, just a mere 43 degrees at about 25 ambient. I am very happy with the way it all turned out.



technical details

CPU

P4 Intel 3.2GHz @ 3.8GHz

MOTHERBOARD

Gigabyte GA-81945P-G

RAM

1GB Corsair Value Select

VIDEO CARD

Albatron 7900GT 512

HDD

250GB SATA II

Extras

- Thermaltake Extreme Spirit 2 northbridge cooler
- ASUS 16x dual-layer DVD burner
- Thermaltake 430W PSU

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FALLOUT

Funnies and humour from the fallout zone

“ Combined they formed a ball of pain, a kidney stone in the urinary tract of my patience...”

archeological endeavours proved useless and it was only after I resigned to my throne in the kingdom of noob and tapped my query into Google's taunting search box that I discovered 'Programs and Features' to be the new hiding place for what I sought.

I think the largest sigh was birthed by Vista's new 'bread-crum' navigation. Instead of leading me to some sort of delicious cheesecake representing the pinnacle of interface design, I sadly found myself outside a house fabricated entirely from gingerbread, door wide open to a creepy indoor scene complete with cackling witch, exposed oven and grossly overweight Germanic children.

God I love cheesecake.

All little things by themselves, yes, but combined formed a ball of pain, a kidney stone in the urinary tract of my patience. And I wasn't going to let myself nor the poor bastard suffer any longer.

But, as I reached over to my Windows XP CD a strange feeling began to bubble in the pit of my belly. I just couldn't do it. I would be going backwards and I knew that once I had XP back on my system I would, for reasons unfathomable, begin to miss Vista.

So I'm going to stick it out. As much as I like the idea of being stuck in operating system limbo, the smell of hobo, old pants and stale spit is close to overwhelming. ☹

P.O.S. = Perfect Operating System?

Logan Booker doesn't want to be stuck in limbo with a smelly hobo for company.

Perfection is a foolish thing to strive for, and my soul burns in the righteous fires of apathy the second I think otherwise.

Yet, even with this most pessimistic of statements flapping free in the wind like Superman's cape or a pair of tattered hobo pants attached to head of their insane owner by nothing but a line of saliva and several ghastly-looking staples, I would never dissuade someone from trying to achieve a state of flawlessness.

However, certain recent experiences with Windows Vista, Microsoft's latest operating system, have left my own high ambitions scattered to the four corners of the Earth and perhaps a ceiling nook on the Moon.

Beneath the shining gloss of Aeroglass, Vista's 3D accelerated GUI, rests a dead heart

of solid rock. Not that rocks beat, have hearts, or even understand the complex concepts of life and death, but the analogy is quite fitting if you can suspend your disbelief or at the very least, ambush it with a chloroform-soaked sock.

For a time, I hacked away at Vista's unrelenting exterior in an attempt to fashion something I could work with or understand.

Time and time again, I failed.

First, I valiantly searched for Display Properties until an assault of random clicking in the Desktop's right mouse button menu revealed that this functionality had been rerouted to 'Personalize Desktop'.

Next, seeking to uninstall an unwanted application, I performed a desperate excavation of Vista's Control Panel. My pseudo-

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LINUX DISTRO HEAD TO HEAD

Ubuntu, Debian, Gentoo, Fedora... there are plenty of Linux distributions to choose from, all with their own strengths and weaknesses. Leigh Dyer takes the best of the best and lets you know which ones make the Atomic grade for speed, configurability and features.

RICHARD GARRIOTT

We interview the father of the computer role-playing genre. Find out how Garrriott plans to reintroduce the fun and remove the grind from massively multiplayer online games with Tabula Rasa.

MAKING MUSIC WITH LINUX

Leigh Dyer begins constructing a top-notch OS environment for building ballads in Linux, including recommend software and hardware. Be sure to read part 1 of this three-part series, and fire up your latent talents for song and dance.

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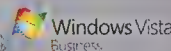
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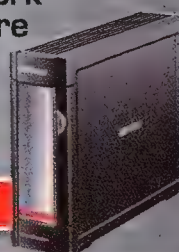
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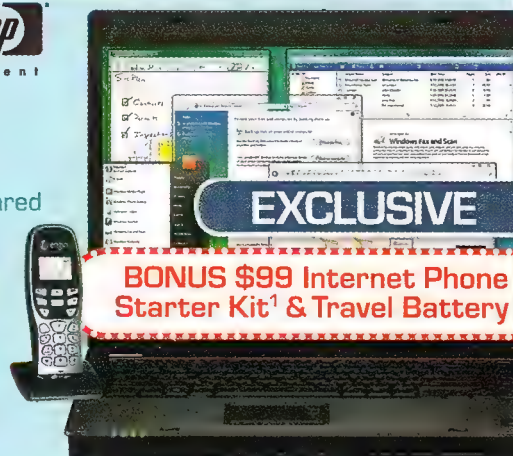
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- Windows Vista Business
- 1 year warranty

\$1899

U6011 | RENT \$21.92/wk*



EXCLUSIVE

BONUS \$99 Internet Phone Starter Kit¹ & Travel Battery

GREAT VALUE, GREAT TECHNOLOGY



BONUS BAG

\$149 CASHBACK²

TravelMate 2484WXM

- Intel Celeron M 440 1.8GHz
- 512MB DDR2 RAM
- 80GB* Hard Drive
- DVD SuperMulti Dual Layer Drive
- 14.1" WXGA Widescreen
- Wireless LAN 802.11b/g
- Weighs 2.4kg
- Windows Vista Home Basic
- 1 year warranty

acer



\$849 BEFORE CASH BACK
YOU PAY \$998

U6026 | RENT \$11.55/wk*

VERSATILE MOBILE PERFORMANCE



BUILT WITH TOSHIBA
EASYGUARD TECHNOLOGY

Satellite Pro A120

TOSHIBA

- Intel Core 2 Duo T5500 1.6GHz
- 512MB DDR2 RAM
- 80GB* Hard Drive
- DVD SuperMulti ±Dual Layer Drive
- 15.4" WXGA Widescreen
- Wireless LAN 802.11a/b/g
- Weighs 2.9kg
- Windows Vista Business
- 1 year warranty



\$1539

U5666 | RENT \$17.26/wk*

optional accessories

Samsung 940BW 19" Widescreen LCD Monitor
\$340 | U2943



Samsung 206BW 20" Widescreen LCD Monitor
\$529 | U5892



optional accessories

Targus Radius Top Loader (15.4")
\$99 | 20384



512MB RAM Upgrade for Toshiba A120
\$119 | U5145

Boost your productivity...

TravelMate 4234WLMi

Boost Your Productivity With Dedicated Graphics

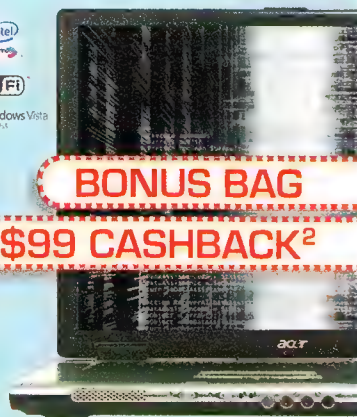
- Intel Core 2 Duo T5600 1.8GHz
- 1GB DDR2 RAM
- 160GB* Hard Drive
- DVD SuperMulti +Dual Layer Drive
- 15.4" WXGA Widescreen
- nVidia Go 7300 with up to 256MB TurboCache
- Wireless LAN 802.11a/b/g
- Bluetooth v2.0
- Up to 3.5 hours of battery life
- Windows Vista Business
- 1 year warranty

\$1899 BEFORE CASH BACK
YOU PAY \$1998

U6256 | RENT \$22.40/wk*



BONUS BAG
\$99 CASHBACK²



Tecra A8

Perfect Toshiba Quality & Reliability for Business

- Intel Core 2 Duo T5600 1.8GHz
- 1GB DDR2 RAM
- 80GB* Hard Drive
- DVD SuperMulti ±Dual Layer Drive
- 15.4" WXGA Widescreen
- Wireless LAN 802.11a/b/g
- Weighs 2.9kg
- Up to 3 hours battery life
- Windows Vista Business
- 1 year warranty

\$1949

U4929 | RENT* \$21.85/wk*



TOSHIBA

**BONUS BAG,
MOUSE & HUB**



POWERFUL DEDICATED GRAPHICS

\$100 PRICE DROP

SPECIAL \$99 19" LCD MONITOR³

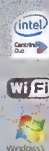
3000 N100

lenovo

- Intel Core 2 Duo T5600 1.8GHz
- 1GB DDR2 RAM
- 120GB* Hard Drive
- DVD SuperMulti ±Dual Layer Drive
- 15.4" WXGA Widescreen
- nVidia GeForce Go 7300 with 128MB
- Wireless LAN 802.11a/b/g
- Bluetooth v2.0
- Weighs 2.8kgs
- Windows Vista Business
- 1 year warranty

\$1899

U5351 | RENT \$21.29/wk*



Brilliant Value \$99 19" Widescreen LCD Monitor³

Purchase select Lenovo Notebooks and be eligible to purchase a 19" Widescreen LCD Monitor for \$99. Only one monitor per notebook. \$99 | U5751



ULTIMATE POWER WITH DEDICATED GRAPHICS

BONUS \$99 INTERNET PHONE STARTER KIT¹

nx8420

- Intel Core 2 Duo T7200 2GHz
- 1GB DDR2 RAM
- 120GB* Hard Drive
- DVD SuperMulti ±Dual Layer Drive
- 15.4" WXGA Widescreen
- ATi Mobility Radeon X1600 with 256MB
- Wireless LAN 802.11a/b/g
- Bluetooth v2.0
- Weighs 2.7kg
- Windows Vista Business
- 1 year warranty

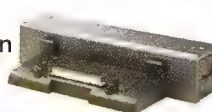
\$2299

U4577 | RENT \$24.93/wk*



optional accessories

HP Docking Station for nx series
\$295 | T7178



1GB DDR2-667 RAM for HP Notebooks
\$229 | T7407

POWER OF A DESKTOP, PORTABILITY OF A NOTEBOOK

\$99 CASHBACK²

BONUS BAG

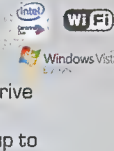
TravelMate 5625WSMi

acer

- Intel Core 2 Duo T7200 2GHz
- 2 x 1GB DDR2 RAM
- 200GB* Hard Drive
- DVD SuperMulti +Dual Layer Drive
- 17" WXGA Widescreen
- nVidia GeForce Go 7300 with up to 256MB TurboCache
- Wireless LAN 802.11a/b/g
- Bluetooth v2.0
- Integrated 1.3 megapixel Orbicam
- Windows Vista Business

\$2499 BEFORE CASHBACK
YOU PAY \$2598

U5958 | RENT \$28.17/wk*



optional accessories

1GB RAM Upgrade for Acer TM5625WSMi
\$229 | U5797



Harris Technology 3 Year Extended Warranty Plan - Protect your investment for peace of mind!
\$239 | S0601 (Up to \$2000 notebook)
\$289 | S0602 (Up to \$4000 notebook)

Desktop & Display

Great value Desktop and Display offers...

Apple iMac 20"



Authorised
Solutions Reseller

- Processor: Intel Core 2 Duo 2.16GHz Dual-Core
- Memory: 1GB DDR2 II SDRAM
- Hard Drive: 250GB* SATA Drive (7200RPM)
- Optical Drive: Slot load 8x Double Layer DVD±RW Superdrive
- Operating System: Mac OS X v10.4 Tiger
- Display: 20" widescreen LCD with 1680 x 1050 resolution
- Warranty: 1 year limited



\$2299

A7340 | RENT \$24.93/wk

AT3220B LCD TV

acer

- AT3220B: 32" (80cm)
- Resolution: 1366 x 768
- Brightness: 500 nits
- Contrast ratio: 1200:1
- Response Time: 8ms
- Weight: 17.7kg
- HDMI Input
- HD TV ready



HOT PRICE

\$949

A7460 | RENT \$10.98/wk

*See page 16 for Rentsmart terms & conditions

#Available capacity of hard drive may be less due to preinstalled software.

¹Purchase any advertised Toshiba projector until 31/05/07 and receive cashback of \$120 via redemption directly from Toshiba. Visit toshiba.ht.com.au for redemption form and full terms and conditions. Postage charges may apply

²Engin bonus via redemption only from engin.ht.com.au. Terms & conditions & postage charges may apply.

AL1916WD

acer

- Viewable Image: 19" Wide
- Interface: Analogue & Digital
- Resolution: 1440 x 900
- Response Time: 5ms
- Contrast Ratio: 700:1
- Brightness: 300 nits
- Warranty: 3 years limited



\$335 | U4521

J115 Microtower

lenovo



- Processor: AMD Athlon 64 X2 3800+ Dual Core
- Memory: 1GB (2 x 512MB) DDR2
- Hard Drive: 250GB* SATA (7200RPM)
- Optical Drive: 16x Dual Layer DVD+/-RW
- Operating System: Microsoft Windows Vista Business
- Warranty: 1 year limited onsite



Windows Vista
Business

\$999

S9366 | RENT \$11.56/wk*

P8 DLP Projector

TOSHIBA

- Resolution: XGA
- 1500 ANSI Lumens
- Contrast ratio: 2100:1
- Weight : Compact 1kg
- Perfect combination: extremely mobile and bright
- Includes soft carry case and remote
- Warranty: 3 year limited



ULTRA LIGHT & PORTABLE

\$120 CASHBACK OFFER¹

\$2499

T3878 | RENT \$27.10/wk*

206BW

SAMSUNG

- Viewable Image: 20" Wide
- Interface: Analogue & Digital
- Resolution: 1680x1050
- Response Time: 2 ms
- Contrast Ratio: 3000:1
- Brightness: 300 nits
- Vista Certified
- Warranty: 3 years onsite exchange and zero dead pixel policy



VISTA CERTIFIED

\$529 | U5892

optional accessories

Logitech Harmony
Advanced Universal
Remote 1000i
\$699 | U5173



Microsoft Wireless Optical Desktop
2000 | \$99 | T9770



6 SMART REASONS TO RENT

- Affordable monthly repayments
- Save your money
- Tax deductible
- Always have the latest equipment
- Get more equipment
- Fast approval



TLP-X2000 LCD Projector

- Resolution : XGA
- 2000 ANSI Lumens
- Contrast ratio: 400:1
- Weight: 2.8kgs
- Quick start & shutdown function
- Password security & control panel lock
- Includes remote with laser pointer
- Warranty: 3 year limited

TOSHIBA



\$120 CASHBACK OFFER¹

\$1879

T8677 | RENT \$21.07/wk*

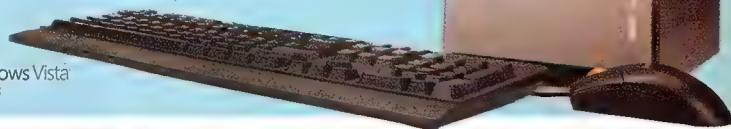
J110 Microtower

lenovo

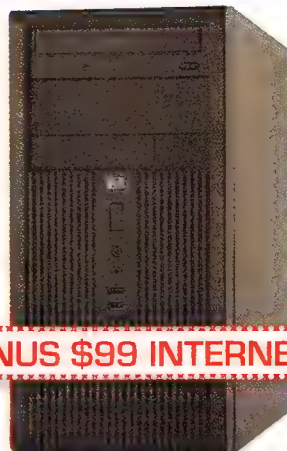
- Processor: Intel Core 2 Duo E6300 Dual Core
- Memory: 1GB (2 x 512MB) PC4200 DDR2
- Hard Drive: 250GB* SATA (7200RPM)
- Optical Drive: 16x Dual Layer DVD+/-RW
- Operating System: Microsoft Windows Vista Business
- Warranty: 1 year Limited onsite

\$1199

S9367 | RENT \$13.87/wk*



HT EXCLUSIVE



DX2250 MicroTower

- Processor: Athlon X2 3800+ Dual Core
- Memory: 1GB DDR2 (2 x 512MB)
- Hard Drive: 160GB* SATA (7200RPM)
- Optical Drive: 16x Dual Layer DVD+/-RW
- Operating System: Microsoft Windows Vista Business
- Warranty: 1 year limited onsite



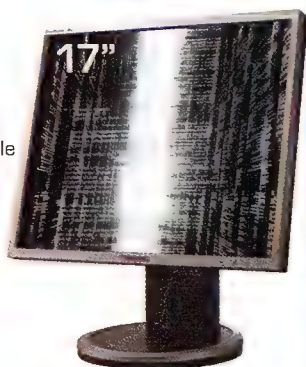
BONUS \$99 INTERNET PHONE STARTER KIT²

\$1049

U5715 | RENT \$12.14/wk*

740B

- Viewable Image: 17"
- Interface: Analogue & Digital
- Resolution: 1280x1024
- Response Time: 5ms
- Contrast Ratio: 600:1
- Brightness: 300 nits
- Stand: Pivot & Height Adjustable
- Warranty: 3 years onsite exchange and zero dead pixel policy



\$320

BLACK | U6599
SILVER | U6600

VT-490 LCD Projector

- LCD Technology
- SVGA resolution
- 2000 ANSI Lumens
- Contrast Ratio: 600:1
- Wall colour correction
- Compact: 2.9kg
- Security function
- Quick start and power off function
- Includes soft carry case and remote
- 2 years limited warranty

\$1199

U1309 | RENT \$13.87/wk*

NEC



optional accessories

Toshiba
Projector
Screen 92"
16:9 Pull Down
\$459 | S9637



Neo-Flex Notebook/Projector Lift
Stand | \$119 | U6591



Logitech USB Desktop
Microphone
\$48 | H8689



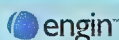
Logitech Premium
USB Headset 350
\$69 | R7934



Phones & Networking

Keep in touch...

Voice Box Series 3



The ultimate box

- All in one unit allowing you to connect multiple devices such as PCs and notebooks wirelessly to broadband
- ADSL2 plus modem
- Allows you to run two phone lines
- Ideal for the modern home or office

Save up to 55% on your phone bill!
Connect your existing home or office phone through your broadband internet service.



\$249 | T7230

DSS7960+1
Dual Line Phone

- Distinctive caller ID indicators
- Digital duplex speakerphone on handset
- 2 line dual keypad cordless phone
- 5.8GHz digital spread spectrum technology phone system
- Multi (10) handset capable (2 handsets included)



BONUS Headset

\$269 | U4664

Uniden HS910 Headset | \$29.95 | U0574

¹ Purchase any GPS Powered by Whereis from April 1st 2007 until May 31st 2007 and receive \$50 cashback via redemption from Sensis. Visit sensis.ht.com.au for further details. Postage charges may apply.

^{*} Refer to back page for Rentsmart terms & conditions.

DID YOU KNOW

You can now quickly search for and order our entire range of more than 15,000 technology products online at ht.com.au.

Click and try it out today.

\$50 cash back offer
on GPS units¹

Powered by
Whereis

GNS8350 GPS Navigation

Uniden

- High definition 3.5" LCD display
- Simple & easy to use touch control screen
- Easy to navigate maps
- Unique night mode for easy glare free view



\$499 BEFORE CASHBACK
YOU PAY \$549¹

U0576

\$50
cash back offer
on GPS units

Digiwalker A701 Phone/
PDA/GPS

- Intel® PXA-270 520MHz
- Memory: 128 MB Nand Flash / 64 MB SDRAM
- GSM Tri Band GSM/GPRS
- GPS Built-in GPS module SiRFStar III chipset
- SD/MMC SD/IO, MMC-compatible
- Video Display 2.7"
- Touchscreen TFT LCD
- Resolution: 320 x 240, 65K Colours, Portrait
- Connectivity USB 1.1, Bluetooth® 1.2
- Camera Fix Focus 1.3 MP CMOS



\$1049 BEFORE CASHBACK
YOU PAY \$1099¹

U4702 | RENT \$12.71/wk*

\$50
cash back offer
on GPS units

Treo 680

Bring wireless mobile productivity to your small business with the all-in-one Palm® Treo™ 680 smartphone. It delivers full phone functionality plus wireless email, web browsing, messaging, document editing and more. Give your company a productivity boost and realise a quick return on investment with the Treo 680 — the ideal device for your growing business.

**\$799**

U4259 | RENT \$9.24/wk*

2070 USB Phone



- Free Firefly to Firefly calls worldwide
- Free personal Voicemail
- Includes headset
- 128MB memory
- Can be used at internet cafe
- Perfect for travelling

**SAVE \$10****\$39** | U0521

Optio E30 Digital Camera

PENTAX

An entry-level model designed with the convenience of beginners in mind

- 7.1 megapixels
- 3x optical zoom
- 15 shooting modes
- 4x digital zoom
- 2.4" LCD screen

**\$199** | U6157

7.1 MEGAPIXEL 3x OPTICAL ZOOM 2.4" SCREEN 15 SHOOTING MODES

FE-240

OLYMPUS

World's smallest and thinnest 5x optical zoom lens camera with a 38-190mm range

- 7.1 megapixel
- 5x optical zoom lens
- Slim stainless steel body
- 13 optimised scene modes
- Large 2.5" LCD screen

**\$399** | U5436

SBS Server Bundle Proliant ML110G4

- Dual-Core Intel Pentium D Processor 820 2.8GHz-800Mhz-2x1MB L2 Cache
- 2 x 160GB Non Hot Plug SATA Hard Disk Drive
- 1GB PC2-530a0 ECC (DDR2-667Mhz) Memory
- Embedded 4 Port SATA Controller with embedded RAID
- 48x CD_ROM
- Microsoft Windows Small Business Server Standard Edition R2

\$1695

U3865 | RENT \$19.00/wk*



Terastation Pro II NAS 1TB Business Server Edition

BUFFALO

- Ultra-fast data transfer rates of up to 35MB/s - more than twice the speed from TeraStation PRO
- Distributed file system support- allows multiple TeraStation to work seamlessly together as one unit.



\$1799

U5985 | RENT \$20.17/wk*

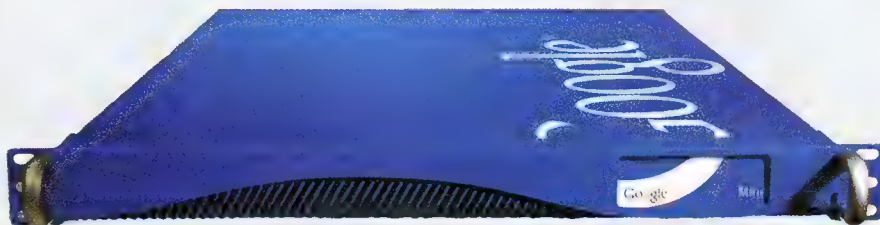
NEW

Google Mini Hardware Search Appliance

Google

The Google Mini is an integrated hardware and software solution designed to help your organization make the most of its digital assets. It does this by delivering the power and productivity of Google search across your documents and websites - quickly, easily and affordably. The new smaller, faster Mini includes support for multiple document collections, search across file servers and improved reporting.

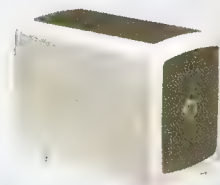
\$4259

 T8261 | RENT \$43.49/wk*


Netgear SC101T Storage Central Turbo

NETGEAR

- Gigabit Ethernet network port, enables transfer of large files in seconds
- Accommodates 2 SATA drives (not included)
- Creates duplicate copies of your files automatically
- Supports SATA drives from 80GB to 1500GB
- Ensures maximum protection against data loss
- Supports additional Storage Central Turbo systems



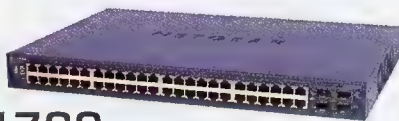
\$399

 U6714

NEW

Netgear GS748TS 48 Port Gigabit Stackable Smart Switch

- Gigabit Stackable Smart Switch enables businesses to grow with ease
- 48 10/100/1000Mbps ports
- Stack up to six units and 288 ports and manage them all from a single IP address



\$1799

U4731 | RENT \$20.17/wk*

Linksys 24 Port 10/100/1000 Gigabit Switch SR2024

LINKSYS

- Twenty-four 10/100/1000Mbps, half/full duplex, switched ports, and two Mini-GBIC expansion ports
- Forwards and filters packets at non-blocking, full wire speed
- All ports have auto speed negotiation and auto MDI/MDI-X crossover detection
- Linksys reliability and limited lifetime warranty



\$699

M5854 | RENT \$8.09/wk*

Linksys NSS4100 Network Storage System Chassis 1.0TB RAID

LINKSYS

- 4 Drive Bay Network Storage System Chassis Supporting RAID 0/1/1+Spare/5/5+Spare/10 and File Encryption Support (Preconfigured RAID 5)
- Advanced Data Protection & Security Features



\$3639

U6722 | RENT \$38.00/wk*

NEW

optional accessories

D-Link DGS-1008D 8 Port 10/100/1000 Un-Managed Switch \$152 | K8853

D-Link DWL-2100AP XtremeG Wireless b/g Access Point \$199 | N6053

optional accessories

Network Installation - Standard Pack \$162 | U5900

Server Installation - Microsoft Server 2003 \$810 | U5898

optional accessories

Netgear WNR834B RangeMax NEXT Wireless Router \$255 | T7507

Linksys WRT300N Wireless N Broadband Router + 4 Ports Switch \$247 | T7735

Computer Accessories

HT has all your computer peripheral needs covered

Voyager 510SL
Bluetooth Headset SystemPLANTRONICS
SOUND INNOVATION

- Convenient One-Touch Control button allows you to seamlessly switch between your office phone and your voice enabled Bluetooth® mobile phone, PDA or laptop
- Noise-cancelling microphone for superior voice transmission
- Up to 6 hours of talk time and up to 100 hours of standby time
- Smart technology knows which device you are using- enabling you to take calls from either device.



\$299 | T2548

Premium Notebook
Headset

Logitech

- Behind-the-head, USB/analogue headset optimised for notebooks
- Adjustable earpieces for a comfortable, secure fit
- Rotating, adjustable, noise-cancelling microphone
- Convenient in-line volume and mute control located on cable



\$99 | U1277

*See page 16 for Rentsmart terms & conditions
 *20% cash back offer is valid from 01/05/07 to the 31/07/07 on selected Microsoft Hardware Products, see microsoft.ht.com.au for full terms & conditions. Postage charges may apply.

DID YOU KNOW

You can now quickly search for and order our entire range of more than 15,000 technology products online at ht.com.au.

Click and try it out today.

Wireless Notebook
Presenter Mouse 8000

Microsoft®

- Smoothly navigate through MS Office, PowerPoint & other presentations from up to 9m away from the PC
- Use Media Remote for multimedia presentations & control digital entertainment

20% CASHBACK OFFER¹

\$149 | U4249

Bluetooth Laser Cordless
Desktop MX5000

Logitech

- The smart desktop that combines an LCD keyboard display, high-speed Bluetooth wireless hub with SecureConnect technology
- Comes with innovative touch-sensitive media controls



\$245 | T3579

diNovo Media Bluetooth
Laser Desktop

Logitech

- Bluetooth MediaPad — long range Bluetooth remote commander
- Combines a numeric pad, calculator & remote control
- LCD display and rechargeable MX Laser mouse



\$329 | T3582

internal hard drives

Seagate Barracuda
320GB PATA
\$165 | U0004



Seagate Barracuda
320GB SATA
\$170 | T9020



8GB USB Flash Drive

COMSOL

- Hi-Speed USB 2.0
- Mac and PC compatible
- True Plug and Play no drivers needed
- Utility program for password security and partitioning functions
- LED to indicate read/write status

MASSIVE 8GB CAPACITY



\$199 | U5794

Cruzer Micro U3 4GB
USB Drive

SanDisk®

- U3 smart enabled
- Hi-Speed USB 2.0 certified [backwards compatible with all USB 1.1 ports]
- Retractable USB connector
- U3 functionality only supported on Windows 2000 (SP4 and later) & XP OS



HOT PRICE

\$94⁹⁵ | T84602GB Micro SD Memory
card

SanDisk®

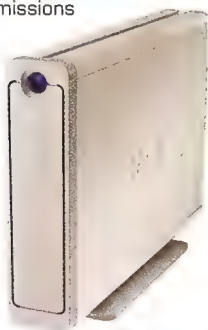
- Universal compatibility with TransFlash™ memory card slots
- Comes bundled with an SD Adapter for use with microSD or TransFlash cards
- Built-in security features enable users to download, store, and play secure content just like an SD card

\$59⁹⁵ | U3749

500GB Gigabit/Ethernet Hard Drive



- Gigabit Ethernet & USB 2.0 interface
- Quick & easy IP configuration
- Expandable capacity through a USB host port
- Users 7 share level permissions
- Jumbo Frame support



\$499 | U4961

One Touch III 1TB Turbo External Hard Drive



- User-configurable RAID solution
- RAID 0 for high performance disk striping or RAID 1 for auto-mirroring
- Fast Data transfer - FireWire 400 and 800 and USB 2.0
- 7200RPM, 16MB cache
- Maxtor Drivelock protection



\$799 | T4613

My Book Pro 1TB External Hard Drive



- 1,000 GB of storage
- USB 2.0/Firewire 400/ Firewire 800
- Capacity gauge
- Raid
- EMC® Retrospect® Express Backup and System Recovery Software



SAVE \$50

\$699

U5601 | RENT \$8.09/wk*

FreeAgent 320GB Desktop Drive



- Footprint is no bigger than a stapler
- 5-year limited warranty
- Just plug it in and you're ready to go
- USB 2.0 interface
- PC and Mac compatible



NEW

\$229 | U6879

Basics 500GB External Hard Drive



- Store your work, photos, songs, and digital videos safely and securely
- Ideal for the office and home PC with easy installation via USB cable
- Includes vertical stand



SAVE \$30

\$299 | U6197

Porsche Design 500GB External Hard Drive



- Hi-Speed USB connection
- 7200 RPM 8MB Cache
- Save photos, MP3s, data files
- Stackable to save desk space
- Back up valuable information



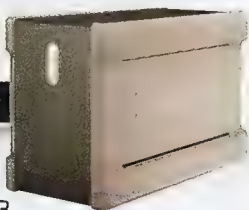
HOT PRICE

\$299 | T9416

One Touch III 320GB External Hard Drive



- USB 2.0 and Firewire
- 7200RPM 16MB cache
- Maxtor "OneTouch" button for easy backup of your data
- 2 Levels of security with Maxtor DriveLock & Encryption



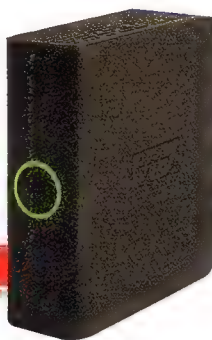
NEW

\$299 | U5223

My Book Essentials 250GB External Hard Drive



- Easy to set up, easy to use, plug it into your computer's USB 2.0 port and start saving.
- Intelligent drive management features — The My Book drive turns itself on and off with your computer



LOW PRICE

\$149 | U5597

160GB External Portable Hard Drive



- Large 160GB storage capacity
- Hi-Speed USB 2.0
- 4 pin USB, 5400 rpm, buffer: 2MB
- Ultra portable slim design
- Sturdy metal casing



HOT PRICE

\$189 | U4680

desktop accessories

Logitech V270 Cordless Notebook Mouse
\$89.95 | T3577



Logitech Cordless 2.4 GHz Presenter
\$99 | S8331



MX Revolution Cordless Laser Mouse
\$159 | T9986



HOT PRICE

Printers

All your printing needs covered..

N6010



HP WARRANTY BONUS¹

Quickly and easily digitise office filing cabinets and organise scans.

- Fast, unattended duplex document scanning at up to 18ppm
- Optical scanning resolution: up to 600 dpi
- Bit depth: 48-bit
- Gray scale levels: 256

\$999

U5394 | RENT \$11.56/wk*

¹ **HP Warranty Bonus**
BONUS 2 years warranty upgrade on selected HP Scanjet Scanners. HP gives you this SMART BUSINESS BONUS with the purchase of your eligible scanner before the end of May 2007. To claim your bonus warranty simply visit hp.ht.com.au for full terms and conditions.

² **BONUS 4 colour toner set** valued at \$279 on purchases of the Samsung CLX-3160 from 01/05/07 to 30/06/07. See samsung.ht.com.au for full details.

³ **Cashback via redemption** from Epson from 01/05/07 to 31/07/07. See epson.ht.com.au for details.

⁴ **Offer valid on purchases** between 01/05/07 to 30/06/07. Visit hp.ht.com.au for more details.

⁵ **Cashback offer via redemption** from Canon from 01/05/07 to 15/07/07. See canon.ht.com.au for details.

⁶ **Offer valid on purchases** between 01/05/07 to 30/06/07. Visit hp.ht.com.au for more details.

⁷ **Cashback via redemption** from Brother from 01/05/07 to 30/06/07. See brother.ht.com.au for details.

⁸ **Via redemption** from HP between 01/05/07 to 30/06/07. See hp.ht.com.au for details.

* Refer to back page for Rentsmart terms & conditions.

Postage charges may apply on all redemptions.

CLX-3160FN

SAMSUNG

- Printer/copier/scanner/fax
- Print & copy speed: up to 16ppm
- Print Resolution: up to 2400 x 600 dpi
- Scan Resolution: 600 x 1200 dpi
- Standard Media Capacity: 150 sheets
- Connection: hi-speed USB, Ethernet 10 Base-T/100 Base-TX
- Warranty: 1 year onsite

BONUS toner set valued at \$279²

\$1099

U6220 | RENT \$16.23/wk*



Stylus RX650

EPSON
EXCEED YOUR VISION

- Printer/copier/scanner
- Print & copy speed: up to 21 ppm mono/colour
- Print Resolution: up to 5760 x 1440 dpi
- Scan Resolution: 3200 x 6400 dpi
- Standard Media Capacity: 80 sheets
- Connection: USB, IrDA
- 2.5" display
- Warranty: 1 year

\$130 CASHBACK³



\$319 | T5919

BEFORE CASHBACK YOU PAY \$449

Pro K5400DTN



- Print speed: up to 36ppm mono/ 35ppm colour
- Print Resolution: 4800 dpi colour
- Duplex (dual sided) printing
- Total Media Capacity: 600 sheets
- PCL 3 support
- Extra paper tray (total paper holding 600pg)
- Connection: hi-speed USB, Ethernet 10 Base-T/100 Base-TX

\$100 CASHBACK & 30 Day Money Back Guarantee⁴

\$299

U7751

BEFORE CASHBACK YOU PAY \$399

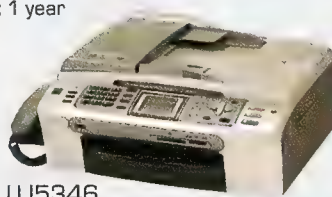


MFC665CW

brother

- Printer/copier/scanner/fax
- Print speed: up to 20ppm (mono) / up to 18ppm (colour)
- Scan Resolution: 600 x 2400 dpi
- Standard Media Capacity: 100 sheets
- Memory: 16MB
- Connection: USB, Ethernet 10 Base-T/100 Base-TX, IEEE 802.11b, IEEE 802.11g
- Warranty: 1 year

\$299 | U5346



MP830

Canon
advanced simplicity

- Printer/copier/scanner/fax
- Print Speed: up to 30ppm (mono) / up to 24ppm (colour)
- Print Resolution: up to 600 x 600 dpi (mono) / up to 9600 x 2400 dpi (colour)
- Scan Resolution: 2400 x 4800 dpi
- ADF & built in duplex
- Standard Media Capacity: 300 sheets
- Warranty: 1 year

\$399

T6987

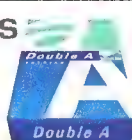
BEFORE CASHBACK YOU PAY \$499



\$100 CASHBACK⁵

optional accessories

Double A A4 White 80gsm
500 page ream
\$6.49 | T4776



optional accessories

Double A A4 White 80gsm
2500 page box
\$31.90 | T4779



Colour LaserJet CM1017



- Printer/copier/ scanner
- Print Speed: up to 8ppm mono & colour
- Print Resolution: up to 600 x 600 dpi
- Scanning Resolution: 1200 x 1200 dpi
- Connection: hi-speed USB, Ethernet 10 Base-T/100 Base-TX
- 6-in-1 card reader
- Warranty: 1 year onsite warranty

\$100 CASHBACK⁶
\$1049

U0877 | RENT \$13.29/wk*

BEFORE CASHBACK YOU PAY \$1149


Colour LaserJet 2840



- Printer/copier/scanner/fax
- 7-in-1 card reader
- Print speed: up to 19ppm mono/4ppm colour
- Print Resolution: up to 600 x 1200 dpi (mono)/ up to 600 x 600 dpi (colour)
- Scan Resolution: 1200 x 1200 dpi
- Connection: hi-speed USB, Ethernet
- Warranty: 1 year onsite
- Windows and Mac compatible

\$1399

S1217 | RENT \$15.69/wk*


BONUS COLOUR TONER PACK⁶

Laserjet 3055 All in One



- Printer/copier/scanner/fax
- Print speed: up to 18ppm
- Print Resolution: up to 1200 x 1200 dpi
- PCL 5e, PCL 6, PostScript 3 support
- Scan resolution: 600 dpi
- Hi-speed USB, Ethernet
- Warranty: 1 year

\$100 CASHBACK⁶
\$649

T4390 | RENT \$8.66/wk*

BEFORE CASHBACK YOU PAY \$749


MFC-9420CN



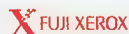
- Printer/copier/scanner/fax
- Print & Copy Speed: up to 31ppm mono/8 ppm colour
- Print Resolution: up to 600 x 600 dpi (mono)/up to 600 x 600 dpi (colour)
- Scan Resolution: 1200 x 2400 dpi
- Standard Media Capacity: 250 sheets
- Connection: Parallel, hi-speed USB, Ethernet 10 Base-T/100 Base-TX
- Warranty: 1 year onsite

\$999 BEFORE CASH BACK
YOU PAY \$1298

T4070 | RENT \$15.02/wk*


\$299 CASHBACK⁷

Docuprint C525A



- Print Speed: up to 25ppm, mono / 5ppm, colour
- Print resolution: 600 x 600 dpi
- Total Media Capacity: 200 sheets
- Connectivity: parallel, USB, Ethernet
- Memory: 64MB
- Monthly Duty Cycle: 45000 pages
- Warranty: 1 year

\$399 | R6445


CLP-300N



- Print Speed: up to 16ppm mono A4/4ppm colour
- Print Resolution: 2400 x 600 dpi
- Total Media Capacity: 150 sheets
- Memory : 64 MB
- Connection: USB, Ethernet
- Warranty: 1 year on site

\$499

U0104



Colour Laserjet 2605DN



- Print Speed: up to 12ppm mono/10ppm colour
- Resolution: 600 x 600 dpi
- Memory: 64MB [expandable 320MB]
- Total Media Capacity: 250 sheets
- Connection: hi-speed USB, Ethernet 10/100Base-TX
- Duplex/Networked
- Monthly Duty Cycle: 35000 pages
- Warranty: 1 year

\$679 | T7115

RENT \$9.01/wk*

BEFORE CASHBACK | YOU PAY \$779

\$100 CASHBACK⁶

optional accessories

Ink for the MFC-665CW Printer

innobella
brother

Ink	Part No.	Price
LC-57 BLACK	U1087	\$31
LC-57 CYAN	U1088	\$17
LC-57 MAGENTA	U1089	\$17
LC-57 YELLOW	U1090	\$17

NEED INK, TONER OR PAPER?


VISIT ht.com.au

for a complete list of all models and brands

MYOB RetailReady Via Redemption

MYOB RetailReady contains all the software and hardware you need to turn your PC into a Point of Sale (POS) solution. RetailReady processes sales fast, reports GST and performs "Cash Ups" in just a few clicks. RetailReady comes with Set Up Assistants [Wizard] that promptly set up your system in around 30 minutes. Get RetailReady today and you can open your store straight away. RetailReady includes 30 days initial support. Ideal if you:

- Are starting a retail business or are tired of using a cash register
- Have your own PC
- Want to create a professional look for your business

\$899 | T0608**CorelDRAW Graphics Suite X3****COREL****\$100 CASHBACK¹**

With this comprehensive graphics suite, you can confidently tackle a wide variety of projects - from logo creation and Web graphics, to multi-page marketing brochures, or eye-catching signs

\$559 FULL | T4499**BEFORE CASHBACK YOU PAY \$659****\$329** UPGRADE | T4590

¹ Valid for full version only, purchases to be made between 1/04/07 and 30/06/07. See corel.ht.com.au for more details.

² Promo valid between 01/05/07 and 30/06/07. See newmagic.ht.com.au for more details.

³ Cashback valid between 01/03/07 and 31/05/07. See corel.ht.com.au for more details.

⁴ Bonus offer exclusive to Harris Technology and Officeworks group. Offer closes 31/05/07. Only available to customers that have up to 4 PCs or less in their business, does not extend to small business that have a server and require installation on a server. See specially marked boxes for full terms and conditions or visit www.smallbusinessoffers.com.au

⁵ Cashback valid between 01/05/07 and 31/05/07. See trendmicro.ht.com.au for more details.

⁶ Cashback valid between 01/05/07 and 31/07/07. Visit microsoft.ht.com.au for more details.

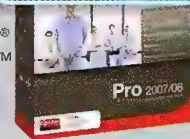
Postal charges may apply on all redemptions

Accounting Plus v16**MYOB**

- The perfect solution for businesses that have employees and provide professional services
- The integrated payroll in MYOB Accounting Plus calculates and tracks PAYG withholdings; long service, annual, holiday and sick leave; superannuation; and other employee entitlements and expenses. Summaries electronically
- Allocate pay items to multiple jobs

**\$499** | FULL | U0170**\$329** | UPGRADE | U0176**QuickBooks Pro 2007/08****Quicken**

- Time billing & job costing
- Integration with Microsoft® Office
- Integrated payroll management
- Track inventory
- Compatible with Microsoft® Windows 2000/XP/Vista™
- 12 months free⁷ technical phone support
- 12 months free⁷ software upgrades

NEW**\$849** FULL | U5974**\$529** UPGRADE | U6171**\$329** SUBSCRIPTION | U6172

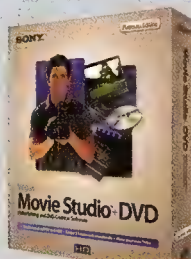
⁷ See pack for details

Creative Suite 3 Design Premium

Adobe® Creative Suite® 3 Design Premium software is the designer's dream toolkit for print, web, and mobile publishing. It combines all-new versions of essential tools for professional page layout, image editing, illustration, and Adobe PDF workflows with new tools for producing engaging websites, interactive experiences, and mobile content—all in a unified, intuitive design environment.

\$2899 | U6349**Adobe****NEW****Vegas Movie Studio + DVD 7 Platinum Edition****SONY**

With Vegas™ Movie Studio+ DVD Platinum Edition you can import and edit video in nearly any format including HDV. Drag and drop to create movies and slide shows with effects, transitions, and music. Share movies on DVD, PSP™, iPod™, and more.

**BONUS PHOTO GO SOFTWARE²****\$219** | U0288**Paint Shop Pro Photo XI****COREL**

- Corel Paint Shop Pro Photo XI builds on the core values set forth by Paint Shop Pro users themselves: easy-to-use yet powerful tools designed with the photographer in mind
- Not only does Paint Shop Pro Photo XI improve on existing features, it also incorporates all-new, one-of-a-kind enhancements, giving users a single application that covers their workflow from start to finish

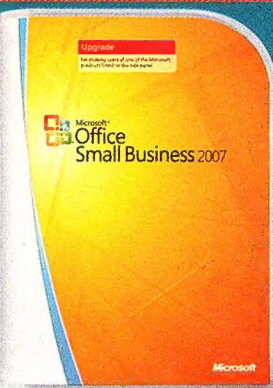
**\$50 CASHBACK OFFER³****\$149** | U0658 **BEFORE CASHBACK YOU PAY \$199****optional accessories**

LaCie 160GB Mobile 2.5" External Drive USB2.0
\$189 | U4680

**optional accessories**

Comsol flashIT2 USB 2.0 Flash Drive - 8GB
\$199 | U5794





Office Small Business 2007

Microsoft Office Small Business 2007 is the complete, powerful and easy-to-use productivity and contact management suite. It offers new tools to help employees at small businesses work more efficiently and effectively so they can deliver better customer service.



\$499 | UPGRADE | U1828 **\$749** | FULL | U1827

BONUS OFFER EXTENDED

Valued at \$229⁴

When you purchase
Office 2007 Small Business Edition
(either upgrade or full)
or **Office 2007 Professional Edition**
(either upgrade or full)

YOU WILL RECEIVE

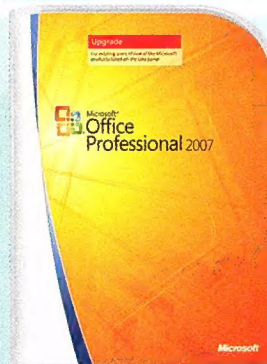
1 hour onsite installation
from Quickknowledge



2 Months complimentary
Online Training on
Microsoft Office
supplied by Quickknowledge

Office Professional 2007

Microsoft Office Professional 2007 is a complete, easy-to-use suite of productivity and information management software to help business professionals save time and stay organised. Powerful features centralise customer, sales and project information in one place so users can respond more quickly to opportunities. Includes all the features of Office Small Business Edition, as well as Microsoft Office Access 2007.



\$549 | UPGRADE | U1831 **\$849** | FULL | U1830

BONUS OFFER EXTENDED

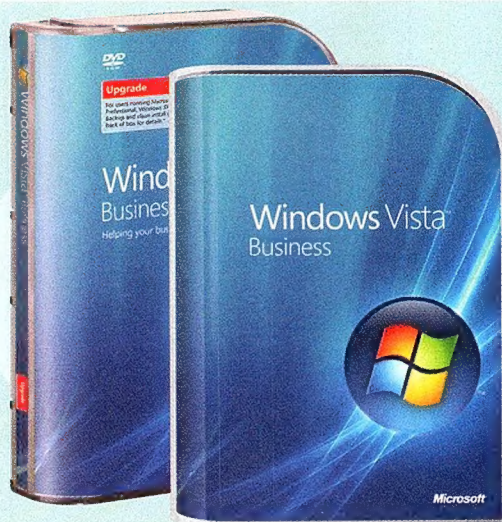
Valued at \$139⁴

When you purchase
Vista Business Edition
(either upgrade or full)

YOU WILL RECEIVE

Transcend 1GB USB Drive with
Ready Boost +

2 Months complimentary
Online Training on Windows
Vista Business supplied by
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Windows Vista Business DVD

Windows Vista Business offers powerful new ways to organise, find, and share information while staying better connected whether you are in the office or on the road. For small businesses, Windows Vista Business will help keep PCs running smoothly and more securely, so you will be less reliant on dedicated IT support.

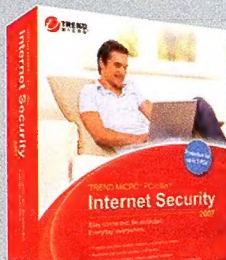
\$379 | UPGRADE | U4504

\$565 | FULL | U4503

Micro PC-Cillin Internet Security 2007 - 3 User

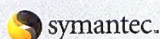


- 3 PCs protected for the price of 1
- Advanced spyware protection
- Free updates and telephone support
- Home network control
- Parental and content controls



\$30 CASHBACK⁵

Norton 360



Norton 360™ delivers all-in-one security for everything the computer users in your family care about. Easy to use, it provides automatic and transparent protection from viruses and spyware, fraudulent Web sites, phishing scams, hackers, identity theft, and more.



\$129 | U6150

Windows Live OneCare 1.5



- Protection Plus protects your files and information from the latest viruses, worms, hackers, spyware and online identity scams
- Install on up to 3 PCs in your household



\$40 CASHBACK⁶

\$59 | U4507 **BEFORE CASHBACK YOU PAY \$99**

1 - 31 May 2007

\$149 CASHBACK¹

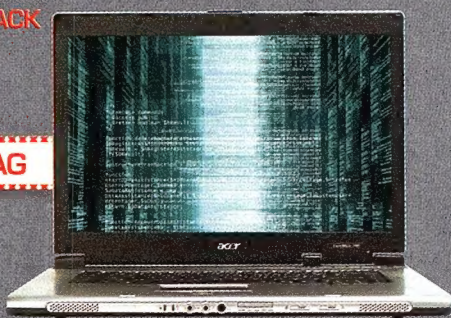
Travelmate 2484WXM
Notebook

\$849 | RENT \$11.55/pw*
U6026

BEFORE CASHBACK
YOU PAY \$998

¹See page 4

BONUS BAG



BONUS TONER SET VALUED AT \$279²



SAMSUNG

CLX-3160FN
Printer

\$1099

U6011

RENT \$12.71/wk*

See page 12

22" WIDESCREEN



SAMSUNG

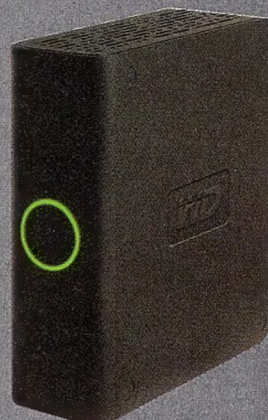
226BW
LCD Monitor

\$749

U5893

RENT \$8.55/wk*

250GB OF STORAGE



WD Western
Digital

MyBook Essentials
250GB External
Hard Drive

\$149

U5597

See page 11

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Mesmerizing 3D Graphics for True Gamers

PowerColor X1950PRO PCIe Xtreme



- ▶ Radeon X1950 PRO
- ▶ 600MHz Core
- ▶ 1.4GHz (700MHz x 2) Memory
- ▶ 256MB or 512MB GDDR3 256 bit
- ▶ Video-In/Video Out (VIVO)
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- ▶ HDCP Ready
- ▶ CrossFire™ Ready



"...we're impressed with the
new X1950PRO..."
PC Authority, Australia



"...quiet and cool..."
Atomic, Australia



"...the best bang for your
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Hard OCP, USA



"...the recommendation of
THG."
Tom's Hardware, Germany



"It is a mainstream card that
I can recommend."
The Inquirer, UK



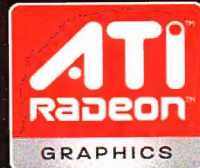
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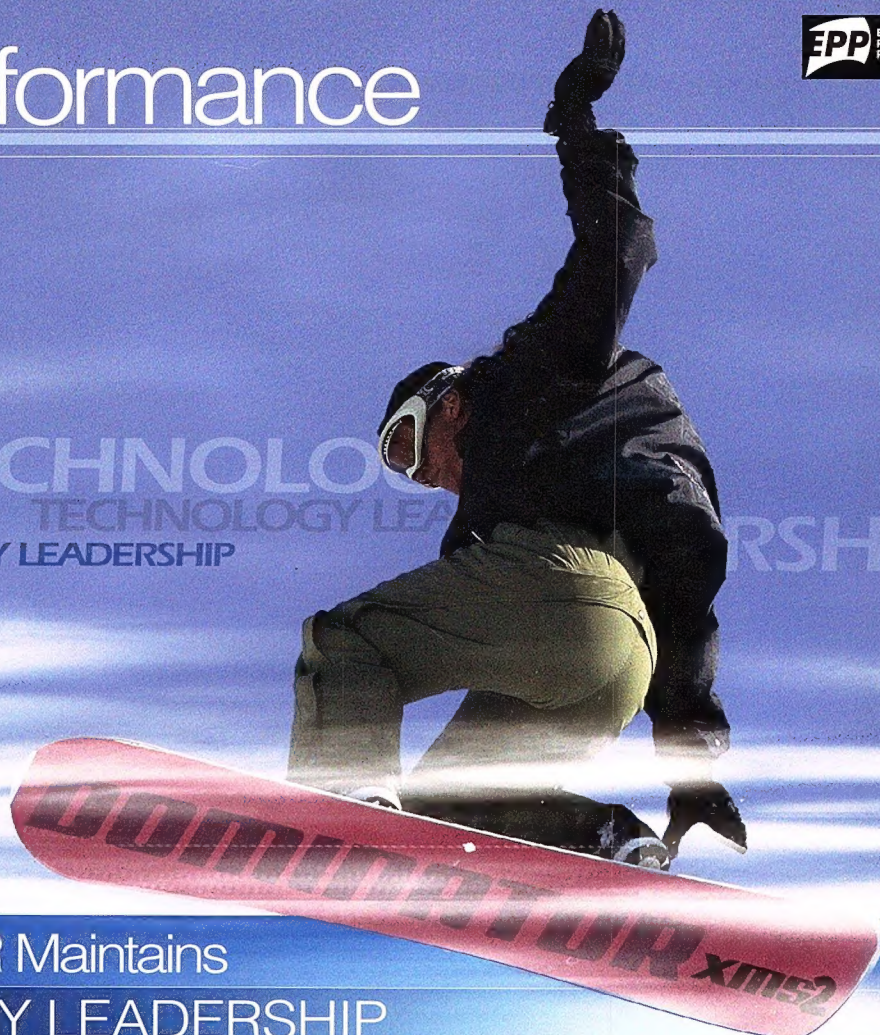


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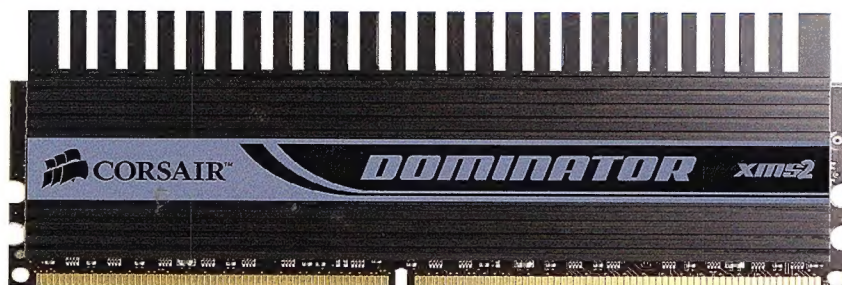
cool performance



TECHNOLOGY LEADERSHIP

How CORSAIR Maintains TECHNOLOGY LEADERSHIP

XMS2



INNOVATION
PERFORMANCE
RELIABILITY

Protect Components While You Push Performance

Pushing performance specs generates heat, and that can compromise reliability and component life. The advanced cooling ability of DHX heat sinks keeps your memory safe and reliable even as you push it to the limit. Under the name XMS2 Dominator, this DHX technology will be showing up on both Corsair parts designed for extreme overclocking and on memory designed for performance computing and gaming.

Also Featuring Enhanced Performance Profiles (EPP)

As with all new Corsair performance memory, XMS2 Dominator modules feature EPP, the new open standard for the Serial Presence Detect (SPD) jointly developed by NVIDIA and Corsair. EPP simplifies overclocking for beginners and provides unparalleled control for experts.



An optional fan (not shown) provides even more cooling and protection.



Corsair's proprietary DHX technology dissipates heat two ways: it draws heat away from the module through the RAMs and provides an additional path for heat transfer within the module through the ground plane!



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